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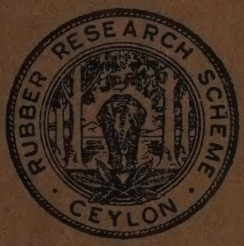

December, 1942

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DARTONFIELD ESTATE—VISITORS' DAYS

N.B.—Owing to reduced war-time staff there will only be one Visitors' Day at Dartonfield each month, namely, the *second Wednesday*. The services of technical officers will be available to visitors on that day ; the Estate Superintendent will be available every Wednesday. Visitors are requested to arrive on the estate not later than 9-30 a.m.

Visitors will be welcomed at the station on other days provided an appointment has been made in advance.

Dartonfield Estate is situated about 3½ miles from the main Matugama-Agalawatta Road, the turn-off being near culvert No. 14/10. The distance from Colombo is approximately 47 miles.

PUBLICATIONS

Rubber Research Scheme publications comprising Annual Reports, Quarterly Circulars and occasional Bulletins and Advisory Circulars are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of Rubber estates in Ceylon over 10 acres in extent. Forms of application for registration may be obtained from the Director. Extra copies of publications can be supplied to the Superintendents of large estates for the use of their assistants.

ADVISORY CIRCULARS

The undernoted Circulars may be obtained on application at 25 cents per copy. Future issues in the series will be sent free of charge to estates registered for the receipt of our publications :—

(1) Notes on budgrafting procedure.

(2) Programme of manuring for replanted Rubber clearings (October, 1941).

(3) Notes on Rubber seedling nurseries (November 1939).

(4) Contour lining, holing and filling, cutting of platforms, trenches and drains (June, 1939).

(5) Straining box for latex (January, 1940).

(6) Notes on the care of budded trees of clone Tjirandji 1 with special reference to wind damage (September, 1938)

(7) Notes on procedure and equipment at Dartonfield Estate factory (May, 1940).

(8) Planting and after-care of budded stumps (January, 1940)

(9) The preparation of latex for shipment (May, 1940)

(10) Root disease in replanted areas (August, 1939)

(11) Emergency rubber coagulants (May, 1940).

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RUBBER RESEARCH SCHEME

Dartonfield, Agalawatta.

CAVE

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TAPPING EXPERIMENTS ON BUDDED TREES

R. K. S. MURRAY, *Botanist.*

Introduction

THIS paper describes a number of tapping experiments which have recently been in progress in budded areas on estates and at Dartonfield and Nivitigalakele under the direction of the Research Scheme.

The ultimate aim of all tapping experiments is the disclosure of the best method of tapping the particular class of planting material on trial according to the local environmental and prevailing economic conditions, attention being directed to the three main criteria : yield, cost of tapping, and effect on the tree. With the mixed seedling populations constituting the bulk of our present plantations experiments should ideally be conducted on a representative range of soils and climates, but with budded trees there is the additional obligation to study the reaction of each clone separately, for clones respond differentially to tapping treatment. In other words it is not correct to assume that the system best suited to Clone A is satisfactory also for Clone B.

A comprehensive scheme to include all the more important clones in varied environments involves an ambitious programme of experiments which it was hoped to implement gradually as and when suitable locations could be found. Until recently the number of monoclone blocks ready for commercial tapping on estates was small, and mainly on account of the difficulty of finding suitable sites the scope of the experiments to be described is very restricted in regard to both clone and tapping treatment. War-time reductions of staff, both at Dartonfield and on estates, have now made the extension of this work impossible for the time being, and indeed Experiments 1, 2 and 3 have had to be discontinued. The present is therefore an appropriate time to take stock of the results so far obtained.

Experiment No. 1. Clone Tjirandji 1

Experimental Details

Site.—The area occupied by this experiment consists of two blocks, one of 18 acres on Estate Y in the Ratnapura District, and the other of 17 acres on Estate A in the Kalutara District. both

of which were budded in the field in 1931-32. The former is situated at an elevation of nearly 1,000 feet, and the growth of the trees has been retarded partly by Oidium leaf disease, the incidence of which is rather heavy at this level, and partly on account of the trees being interplanted with tea. The area on Estate A is more typical of wet zone low-country conditions, and this is reflected in a higher level of yield (see Table II). The average annual rainfall on both estates is about 200 inches.

Except for a few trees on Estate A which had been test-tapped during the previous year no tapping had been undertaken until the experiment was commenced in April, 1939. The criterion of tappable girth was 18 inches at 36 inches from the union and the average tapped stand per acre 111 on Estate Y and 118 on Estate A.

Treatments.—The systems of tapping under comparison are as follows :—

Tapping System	Opening height of cut/s ins. above union	Bark consumption ins. per annum
1. One half spiral on alternate days S/2, d/2, 100%	34	6
2. One-third spiral on alternate days S/3, d/2, 67%	24	6
3. One-half spiral every three days S/2, d/3, 67%	26½	4½
4. Double-four, *i.e.*, two opposite half spiral cuts once in four days, 2S/2, d4, 100%	39 & 21½	2 × 3½, (*i.e.*, 3½ ins. on each panel)
5. Full spiral once in four days S/1, d/4, 100%	21½	3½

Tapping was stopped for an average of 6 weeks during the wintering periods. No change of panels was made.

The opening heights and the rates of bark consumption were calculated on a 10-year cycle of renewal for each system, allowing for the bottom 4 inches of bark immediately above the union being left untapped. (On Estate A the scheduled rates of consumption were exceeded). Although the experiment was planned to run for 10 years it was necessary to discontinue it after the third year of tapping.

Layout and Tapping Arrangements.—The unit plot was a tappers' task of 200 trees. (For systems 4 and 5 the plot was divided into two tasks, each of 100 trees. These treatments were therefore rather favoured as regards yield because 100 trees with two half spiral cuts or with a full spiral can be tapped more quickly, or more carefully, than 200 trees each with one half spiral).

The plots were arranged in four randomised blocks, two on Estate Y and two on Estate A.

In order to eliminate errors due to varying skill the tappers were changed in rotation every two months.

Collection and Recording.—The latex from each plot was weighed in a tared bucket. On Estate A the produce from each plot was separately coagulated, rolled as lace crepe, dried and weighed. On Estate Y it was found inconvenient to coagulate separately, so the dry weight was calculated from the d.r.c. reading of a hydrometer specially graduated for the TJ. 1 latex and checked once a month.

Scrap was weighed wet and 30 per cent deducted for moisture. Late drip after the morning collection was allowed to remain in the cup and added to the scrap.

Supervision.—The supervision of field experiments on outside estates is always a matter of difficulty since the Superintendents, however willing and interested they may be, are seldom able to devote the amount of time desirable to ensure full reliability and accuracy. To overcome this as far as possible the procedure was worked out so as to involve the minimum departure from normal estate practice, and the writer paid periodical visits to inspect the work in the field and check the technique of measurement and recording.

Results.—The results for the three years during which the experiment was in progress are summarised in Table I.

Statistical Data.—The yield figures have been statistically analysed and although the error of the experiment is high, the tapping systems of 100 per cent intensity show significant differences, when compared with those of reduced intensity. The very high error is attributed to the differential treatment response on the two estates. This was not foreseen when the experiment was laid out.

Yield.—The yields are expressed in terms of lbs. of rubber (all grades) per acre for each tapping year (April-March) and as percentages of the yield under system 1 (S/2, d/2, 100%). The figures for lbs. per acre have been calculated on the assumption that the total area of each block is equally divided amongst the several plots, all of which consist of 200 trees.

Dealing first with the two systems of 67 per cent intensity (S/3, d/2 and S/2, d/3), it will be noted that the loss of crop is substantially smaller than the reduction in tapping intensity. This may be partly due to the fact that the cuts were opened at a lower level in keeping with the smaller bark consumption, thus utilising the more productive portions of the panel. There is no evidence of the yield improving in successive years as compared with system 1.

TABLE I

Experiment No. 1, Tjirandji 1. Budded in Field 1931/32. Tapping Commenced April, 1939

Tapping System	Tapping Year	Yield (total rubber)		Av. no. of tappings	Scrap & Lump % of total	Average D.R.C. per cent.	Brown Bast per cent.	Girth increment during 2nd year ins.	Thickness of Renewed Bark mms.
		lb. per acre	Per cent of S/2,d/2, 100%						
1	1	538	100	135	8·6	25·2	—	—	4·9
S/2, d/2; 100%	2	687	100	142	17·0	26·8	—	2·0	5·4
	3	776	100	133	21·2		1·6	—	—
2	1	480	89	135	7·4	26·9	—	—	4.7
S/3, d/2, 67%	2	571	83	138	12·9	27·5	—	2·3	5·6
	3	655	84	132	18·3		1·2	—	—
3	1	436	81	92	7·5	27·5	—	—	4·8
S/2, d/3, 67%	2	554	81	95	16·7	29·6	—	2·3	5·9
	3	596	77	81	19·2		1·9	—	—
4	1	544	101	67	12·6	24·7	—	—	4·8
2S/2, d/4, 100%	2	751	109	70	28·8	26·4	—	1·5	6·1
	3	808	104	66	26·9		2·9	—	—
5	1	535	99	67	11·0	24·1	—	—	4·9
S/1, d/4, 100%	2	730	106	71	25·5	25·6	—	1·8	6·0
	3	832	107	66	25·8		2·6	—	—
Sign diff (19 to 1 odds)	1	39.6	7.4						
	2	103.7	15.1						
	3	86.9	11.2						

System 2 (S/3, d/2, 67%) has given a higher yield than System 3 (S/2, d/3, 67%) and this is consistently found in all experiments where these two methods are compared (see also Tables VI and VII). The latter, however, would have an advantage in cost of tapping.

Table II gives the total yields for the three tapping years for each replication separately. These figures are reproduced to show the relation between the relative yields for the different treatments and the actual levels of yield. It will be noted that the less intense systems have given relatively larger yields on Estate Y (Blocks A and B), where the general level of yield is low, than on Estate A where it is higher. The fact that the plots are only duplicated on each estate limits the reliance which may be placed on this conclusion, but it is in keeping with the general experience that trees growing under good agricultural conditions can be tapped more severely than those less favourably situated.

TABLE II

Experiment No. I. Tjirandji I. Yields by Blocks, Total for 3 Years

Block	Estate Y				Estate A			
	A		B		C		D	
Tapping System	lb. per acre	per cent	lb. per acre	per cent	lb. per acre	per cent	lb. per acre	per cent
1. S/2, d/2, 100 %	1,631	100	1,658	100	2,486	100	2,196	100
2. S/3, d/2, 67 %	1,482	91	1,410	85	2,133	86	1,778	81
3. S/2, d/3, 67 %	1,431	88	1,294	78	1,775	71	1,769	81
4. 2S/2, d/4, 100 %	1,644	101	1,611	97	2,665	107	2,417	110
5. S/1, d/4, 100 %	1,652	101	1,597	96	2,637	106	2,401	109

Systems 4 (2S/2, d/4, 100%) and 5 (S/1, d/4, 100%) may be considered together as they give almost identical results. After a lower yield in the initial months owing to the slower wound response with the four-day interval, the yield of total rubber on these two systems has remained slightly higher than on S/2, d/2, 100%. All the extra crop, however, is in the form of "lump" resulting from late dripping after the normal time of collection. In commercial practice it would sometimes be possible and profitable to reduce the proportion of low grade rubber by making a second collection of latex in the afternoon. Attention must again be drawn to the fact that these systems are slightly favoured owing to the tapping tasks being smaller relative to S/2, d/2, 100% than they would be in commercial practical

Reference to Table II will show that the response to systems 4 and 5 has been better on Estate A (Blocks C and D) than on Estate Y (Blocks A and B), and it is reasonable to attribute this

to the more favourable conditions for growth and yield on the former site. Further evidence is necessary, however, before it could be concluded that 2S/2, d/4, 100% or S/1, d/4, 100% can only be profitably adopted on trees which fulfil a certain standard of size or foliar condition.

Proportion of Low Grades.—The proportion of low grade rubber shows a progressive increase for systems 1, 2 and 3 owing to a larger amount of late drip. In systems 4 and 5 the figure appears to have reached an equilibrium in the second year owing to the late dripping habit developing earlier with the four-day interval. Prolonged flow is a characteristic of Tjirandji 1 and a high percentage of low grades must be expected unless a second collection of latex is made in the afternoon.

Dry Rubber Content.—This is determined from the latex as it comes from the field, days on which partial "washouts" occur being excluded. The less intense methods of tapping, S/3, d/2, 67% and S/2, d/3, 67%, have given the more concentrated latex. The rubber contents are very low throughout but are increasing with advancing age of the trees.

Cost of Tapping.—No direct evidence as to relative tapping costs is provided in this or other experiments described in this paper, and the only comparison for which a calculation may fairly be made from the data presented is between system 1 (S/2, d/2, 100%) and 3 (S/2, d/3, 100%). The size of the tappers' tasks in systems 2, 4 and 5 is relatively smaller than would be the case in commercial practice.

Brown Bast.—An accurate census of the trees with Brown Bast was made during the third tapping year, and the percentages for each treatment are given in Table I. These trees are not all out of tapping, for if one side went dry a cut was opened on the opposite panel. Systems 4 and 5 show the highest figures, but in no case is the incidence sufficiently serious to condemn the tapping treatment. These figures, and indeed all the data, should be viewed in the light of the actual numbers of tapping days per annum, which indicate the true intensities of the several systems. In a drier locality, where fewer tapping days are lost on account of rain, the increased intensity might reveal the severer systems in a more unfavourable light as regards this disease.

Girth Increment.—Girth measurements were made at a height of 36 inches from the union. The increases during the second year of tapping vary inversely with the amount of rubber extracted from the trees. Shortage of staff made it impossible to measure the increments during the third tapping year.

Bark Renewal.—These figures are based on measurements made on one tree in every ten by an officer of the Research Scheme. The rate of bark renewal is somewhat greater for systems 4 and 5 than for system 1, probably owing to the interference to down-

ward translocation of food substances due to the "ringing" effect of a cut or cuts on the whole circumference. This may be off-set by poorer renewal below the cut when new panels are come to be opened. For all treatments the renewal may be considered satisfactory.

Experiment No. 2. Clone Bodjong Datar 5

Experimental Details.

In most respects the experimental details are the same as those for Experiment No. 1, and only important differences are noted below.

Site.—A block of 20½ acres on Estate A. The history of the area is similar to the Tj. 1 block on the same estate. The tapped stand per acre was 105.

Treatments.—The same as for Experiment No. 1, with the omission of systems 2 and 3.

Layout.—The plot size was 180 trees as the field was not large enough for 200 tree plots.

Results

The results are presented in Table III in the same form as for Experiment No. 1.

Yield.—There is the same indication of higher yields on systems 4 and 5 than on system 1, especially in the second year, though in contrast to Tjirandji 1 the gain is not all in the form of low grade rubber. The difference between S/1, d/4, 100% and S/2, d/2, 100% in the second year is statistically significant judged by the criterion of a 19:1 chance. The relative decrease in the third year may be associated with the cuts on system 1, which started at a greater height, coming on to the more productive portion of the tapping panels, *i.e.*, 18 inches to 10 inches.

Proportion of Low Grades.—The proportion of low grade rubber is much smaller than in the case of TJ. 1 owing to the fact that there is not much late drip. Systems 4 and 5 again give rather more scrap than system 1.

Dry Rubber Content.—The figures for dry rubber content of the latex are extremely low though a progressive annual increase is evident. There is no difference between the treatments.

Brown Bast.—The proportion of trees with Brown Bast at the end of the third tapping year is rather high for all systems, but on most trees only a small portion of the cut was affected and tapping could be continued after making an isolation V cut. Systems 4 and 5 appear to evoke more Brown Bast than system 1.

Girth Increment.—Systems 4 and 5 are shown to have retarded the increase in girth by a greater amount than could be accounted for by the small additional extraction of latex. It is clear from these and other similar data (see Table VIII) that tapping on a

TABLE III

Experiment No. 2. Bodjong Datar 5. Budded in Field 1931/32. Tapping Commenced April, 1939

Tapping System	Tapping Year	Yield (total rubber)		Av. No. of tappings	Scrap & Lump % of total	Average D. R. C. per cent.	Brown Bast per cent.	Girth increment during 2nd year ins.	Thickness of Renewed Bark mms.
		lb. per acre	per cent. of S/2, d2, 100%						
1	1	438	100	141	3·4	23·7	—	—	5·3
S/2, d/2, 100%	2	686	100	141	5·5	25·5	—	3·4	5·9
	3	725	100	126	6·1	28·2	3·2	—	—
4	1	430	98	70	3·5	23·0	—	—	5·5
2S/2, d4, 100%	2	713	104	71	7·2	24·8	—	2·2	6·3
	3	738	102	63	7·1	28·5	4·2	—	—
5	1	446	102	71	3·7	22·9	—	—	5·6
S/1, d4, 100%	2	743	108	71	6·4	25·0	—	2·5	6·4
	3	740	102	63	7·7	28·2	4·7	—	—
Significant difference (19 to 1 odds)	1	38·4	Differences not significant					0·52	0·38
	2		5·6						
	3		Differences not significant						

full circumference (or two opposite half cuts) involves some extra disturbance of the normal metabolic processes which is reflected in decreased rate of growth.

Bark Renewal.—At the end of the second tapping year the thickness of renewed bark was significantly greater for systems 4 and 5 than for System 1, though renewal is quite satisfactory for the latter treatment.

Experiment No. 3. Clone Tjirandji 16

Experimental Details.

The experimental details are similar to the two experiments described above, with the following differences.

Site.—A block of 21 acres on Estate H in the Ratnapura District. The elevation is about 600 feet, but apart from the fact that the incidence of Oidium is rather greater than in most low-country localities the general conditions for growth and yield are satisfactory. The average annual rainfall is about 200 inches, but the years during which the experiment was conducted were exceptionally wet. The tapped stand per acre was 114.

Treatments.—These were the same as for Experiment No. 2, but tapping was not commenced until August, 1939. Hence it is possible to include the results for only two completed tapping years. In contrast to the other experiments tapping was continued throughout the wintering periods.

Layout.—The plot size was 200 trees.

Results

The results are presented in Table IV. None of the treatment effects is statistically significant.

Yield.—The yield figures for the second year of tapping are rather difficult to interpret because a storm of exceptional violence uprooted a considerable number of trees in May, 1940, and by ill-fortune the treatments were not affected equally. Again in May, 1941, a number of trees were lost, the same plots suffering the worst damage. The position is summarised in Table V.

TABLE V

Experiment No. 3. Wind Losses in Monsoon Storms

Tapping System	Total No. of Trees	No. of trees destroyed		Substitutes taken into tapping
		May, 1940	May, 1941	
1. S/2, d/2, 100 %	800	36	2	25
2. 2S/2, d/4, 100 %	800	57	6	29
3. S/1, d/4, 100 %	800	67	20	26

An endeavour was made to restore the full number of trees per plot by taking into tapping any trees within each plot which were too small when the experiment was started but had since

TABLE IV

Experiment No. 3 Clone Tjirandji 16. Budded in Field 1931/32. Tapping Commenced August, 1939

Tapping System	Tapping Year	Yield (total rubber)		Av. No. of tappings	Scrap & Lump % of Total	Average D. R. C. lb. per gallon	Brown Bast per cent.	Thickness of Renewed Bark mms.
		lb. per acre	per cent. of S/2, d/2, 100%					
1	1	598	100	129	18·1	2·63	—	4·8
S/2, d/2, 100%	2	683	100	154	21·1	2·57	1·4	5·1
4	1	613	103	64	20·2	2·67	—	5·8
2S/2 d/4, 100%	2	688	101	77	22·3	2·53	0·7	6·3
5	1	604	101	64	19·0	2·63	—	5·7
S/1, d/4, 100%	2	688	101	77	20·4	2·50	2·0	5·9

attained the requisite girth of 18 inches. The numbers of these "substitutes" are given in the last column of Table V. Since the storm damage could not possibly be related to the tapping treatment the actual yields for the second year of tapping have been corrected for the nett loss of trees, *i.e.*, the total loss less the number of "substitutes." This may not be a strictly valid procedure but it is thought to provide a fairer estimate of the relative yields than the uncorrected figures. For neither set of figures, however are there any significant differences.

Proportion of Low Grades.—The high figures for the proportion of low grades in all treatments are due to large amounts of lump resulting from late dripping. This is accentuated in wet weather since the tappers are often obliged to collect their latex early to avoid "washouts."

Dry Rubber Content.—This is expressed as lbs. per gallon since the latex is measured in pints rather than weighed. There is no difference between the treatments, nor is there any indication of an increase in the very low figures.

Brown Bast.—The percentages given in the table are based on the original number of trees, *i.e.*, 800 for each treatment. At the end of the second year the incidence of this disease was not important for any of the tapping systems.

Girth Increment.—No reliable data are available for the increases in girth owing to the loss of so many trees by storm damage and the substitution of some of these by smaller trees.

Bark Renewal.—There is a strong indication that systems 4 and 5 have resulted in quicker renewal than system 1, though owing to a high error consequent on irregularities in response to systems 4 and 5 in the different replications the treatment effect does not attain the necessary level to be judged statistically significant. The renewal on S/2. d/2, 100% will probably prove quite adequate.

Experiment No. 4. Clones Tjirandji 1. A. V. R. O. S. 49 and Bodjong Datar 5

Experimental Details.

Site.—The location of this experiment is a block of 14½ acres on Estate G in the Galle District. It was replanted with budded stumps in July, 1931, and in connection with the general level of yield of the new stand it is interesting to record that the old trees only gave about 250 lb. per acre. The average rainfall is approximately 135 inches.

60 trees of each of the three clones were taken into test-tapping on S/2, d/2, 100% in July, 1937, and the experimental tapping of the whole block commenced on 1st January, 1939.

Treatments.—The methods of tapping under comparison are as follows :—

Tapping System	Opening height ins. above union	Bark Consumption ins. per annum
1. S/2, d/2, 100%	40	9
2 S/3, d/2, 67%	28	9
3. S/2, d/3, 67%	28	6

The trees were rested during the wintering period for two weeks in 1940 and 1941, and the tapping panels remained unchanged during the period under review.

Layout and Tapping Arrangements.—The area is divided unequally between the three clones, which are planted in monoclone blocks as follows :—

TJ. 1	5.3 acres
AV. 49	5.8 „
B.D. 5	3.6 „

Each monoclone block is divided equally into three tappers' tasks according to the three treatments. The original numbers of trees per plot (tapper's task) were as stated below. They were increased slightly from time to time as some of the smaller trees reached tappable size.

TJ. 1	198
AV. 49	250
B.D. 5	117

The treatments are thus not replicated within each clone and the data do not have much more than an observational value.

A system of rotation of tappers' tasks was arranged so that the error introduced by variations in skill would be minimised.

Collection and Recording.—The latex from each plot is measured, coagulated separately, rolled into crepe, dried and weighed.

The results for the first three years of tapping are presented in Table VI for each clone separately.

Yield.—The results with TJ. 1 closely confirm those obtained in Experiment 1, and the relative yields for the three years combined are, in fact, almost exactly the same as those on Estate A (see Table II) where the general development of the trees is similar. It may therefore be taken as fairly well established that in the first three years of tapping trees of TJ. 1, which are growing under normal conditions, the relative yields on these three systems are :—

S/2, d/2, 100%	100
S/3, d/2, 67%	80-85
S/2, d/3, 67%	75-80

TABLE VI

Experiment No. 4., Clones Tjirandji 1, Bodjong Datar 5 & A.V.R.O.S. 49

Planted Budded Stumps July, 1931. Tapping Commenced January, 1939

Tapping System	Tapping year	Tjirandji 1					A.V.R.O.S. 49					Bodjong Datar 5				
		Yield		No. of tappings	Av. D.R.C. lb. per gallon	Brown Bast %	Yield		No. of tappings	Av. D.R.C. lb. per gallon	Brown Bast %	Yield		No. of tappings	Av. D.R.C. lb. per gallon	Brown Bast %
		lb. per acre	% of S/2, d/2, 100%				lb. per acre	% of S/2, d/2, 100%				lb. per acre	% of S/2, d/2, 100%			
1	1	616	100	158	2·62		588	100	156	2·62		467	100	158	2·62	
S/2, d/2, 100%	2	599	100	139	3·00		588	100	143	2·81		673	100	142	3·00	
	3	628	100	130	3·19	6·5	662	100	131	3·06	0	717	100	130	3·25	0·8
2	1	514	83	157	2·75		499	85	156	2·69		375	80	157	2·62	
S/3, d/2, 67%	2	505	84	141	3·06		466	79	139	3·00		504	75	141	3·37	
	3	517	82	130	3·25	3·0	492	74	129	3·19	0	550	77	130	3·56	0·8
3	1	443	72	104	3·06		356	60	104	2·75		305	65	103	2·87	
S/2, d/3 67%	2	477	80	93	3·12		387	66	93	2·87		450	67	93	3·25	
	3	496	79	87	3·50	2·0	430	65	86	3·19	0	503	70	87	3·50	0

This deduction assumes that the tapping cuts on the two milder systems are opened at a lower level in accordance with the reduced rate of bark consumption.

The advantage of S/3, d/2 over S/2, d/3 is also shown for Clones AV. 49 and B.D. 5; indeed the loss of crop on the latter system appears to be approximately proportional to the reduction in intensity.

It is disappointing to note that the yield of TJ. 1 and AV. 49 has shown little increase during the three years of tapping, though the reduction in the number of tapping days is partly responsible. B.D. 5, on the other hand, has given progressive increases.

Dry Rubber Content.—The latex from the trees tapped on 67 per cent intensity is more concentrated than that from the trees of S/2. d/2. 100%. Gradual increases in d.r.c. from the original low figures are evident in every plot.

Brown Bast.—The proportion of trees with Brown Bast is rather high (6.5%) in the S/2, d/2, 100% plot of TJ. 1, and this will need to be watched in future years. No trees of AV. 49 have developed this disease, and the incidence in B.D. 5 is negligible.

Experiment No. 5. Clones Glenshiel 1, A. V. R. O. S. 256 and Prang Besar 25

Experimental Details.

Site.—This experiment is in progress in a field of 7¾ acres on Dartonfield Estate which was replanted with budded stumps in June, 1934. Soil conditions are regarded as average for the Kalutara District, Glenshiel 1 being less favourably situated in this respect than the other two clones. The average annual rainfall is about 175 ins., but the year under consideration was exceptionally wet, the figure for 1941 being 212 inches.

The total stand per acre is 107 and the number of tapped trees per acre 99.

Tapping was commenced in March, 1941. The criterion of tappable girth was 18 inches at 36 inches from the union, but in order to obtain the requisite number of trees in the Glenshiel 1 block it was necessary to tap a few trees which were slightly smaller.

Treatments.—Four systems of tapping are under comparison, as follows :—

Tapping System	Opening height inches above union	Bark consumption inches per annum
1. S/2, d/2, 100%	36	6
2. S/3, d/2, 67%	26	6
3. S/2, d/3, 67%	28½	4½
4. 2S/2, d/4, 100%	41 & 23½	2 × 3½

The opening heights and rates of bark consumption are based on a tapping cycle of 10 years, the lowest 6 inches of bark above the union being left untapped.

The tapping year is March-February, though the trees will normally be left untapped through the whole or the greater portion of the latter month for the usual "wintering" rest.

Layout and Tapping Arrangements.—The design of this experiment is entirely different to that of Experiments 1-4, in which the unit plot was a tapper's task. In this experiment the unit plot is a single tree.

In order to allocate the several treatments, the tappable trees within each clone were first arranged in order of merit according to girth and then grouped into "blocks" of four trees each, the biggest four followed by the next biggest, etc. The four tapping systems were then allotted at random to the four trees constituting each group. The total number of trees in tapping is 768 (representing 92 per cent of the total stand of 831), and is equally distributed among the three clones. Thus the number of trees of each clone tapped by each method is 64.

The assembly of the "blocks" by girth rather than by position results in an apparently indiscriminate mixing of the tapping systems in the field, but it was found quite practicable to arrange the tapping tasks so that each day's task is the same as regards the number of trees tapped on each system.

Collection and Recording.—The method of individual cup coagulation is adopted, and at the end of each month the biscuits are placed in a drying chamber for three weeks, weighed and a percentage deducted for the residual moisture. Scrap from the previous tapping is included with the biscuits. On days on which rain causes a partial "washout" the latex is collected and bulked.

Results

Yields.—The results for the first year of tapping are expressed in Table VII in terms of mean total yield per tree in pounds, and percentage of S/2, d/2, 100%. Each clonal block is regarded as a separate experiment within itself and separate analyses of variance have been computed.

Glenshiel 1.—This clone has given considerably the highest yield of the tree, the crop for the year being equivalent to about 585 lb. per acre on S/2, d/2, 100%. The trees have shown a favourable response to reduction of the tapping intensity to 67% since on neither S/3, d/2 nor S/2, d/3 is the yield depressed by a corresponding amount. S/3, d/2 again shows an advantage over S/2, d/3, the difference being statistically significant.

Up to the present system 4 (2S/2, d/4, 100%) has involved a loss in crop of 7.3 per cent but the experience with other clones suggests that it may increase relative to system 1 in the second year.

TABLE VII

Experiment No. 5. Clones Glenshiel 1, A.V.R.O.S. 256 & Prang Besar 25.

Planted Budded Stumps in June, 1934.

Yields for First Tapping Year, March, 1941—February, 1942

Tapping Systems	Glenshiel 1.			A.V.R.O.S. 256			Prang Besar 25		
	Mean total yield per tree in lbs.	Per cent. of S/2, d/2, 100%	Average No. of tappings	Mean total yield per tree in lbs.	Per cent. of S/2, d/2, 100%	Average No. of tappings	Mean total yield per tree in lbs.	Per cent. of S/2, d/2, 100%	Average No. of tappings
1 S/2, d/2, 100% ...	5·47	00·0	124	3·13	100	123	3·70	100	127
2 S/3, d/2, 67% ...	4·44	81·2	124	2·40	76·7	123	2·77	74·9	127
3 S/2, d/3, 67% ...	4·07	74·4	82	2·24	71·6	83	2·66	71·8	84
4 2S/2, d/4, 100% ...	5·07	92·7	62	3·39	108·3	60	3·50	94·5	62
Std. error ...	0·13	2·4		0·09	2·9		0·09	2·4	
Sign. diff. (Odds of 19 to 1) ...	0·36	6·6		0·25	8·0		0·25	6·7	

A.V.R.O.S. 256.—This clone is now realised to be not in the first flight, and it is not surprising to find the level of yield on S/2, d/2, 100% to be equivalent to only about 335 lb. per acre. Systems 2 and 3 have both given higher yields than the theoretical 67 per cent, S/3, d/2, 67% being as usual superior to S/2, d/3, 67%. The double-four system, 2S/2, d/4, 100%, has given a significantly higher yield than S/2, d/2, 100%.

Prang Besar 25.—The yield on S/2, d/2, 100%, at 396 lb. per acre, is fairly satisfactory having regard to this clone's disappointing tapping history elsewhere in Ceylon. The two milder systems show much the same relationship to S/2, d/2, 100% and to themselves as in AV. 256, but the double-four system, 2S/2, d/4, 100% has not so far proved satisfactory.

Brown Bast.—At the end of the first tapping year a careful census disclosed only one case of Brown Bast; this was in System 4 of AV. 256. There were a few trees of G. 1 and P.B. 25 which had small areas of dry bark, and these will be reinspected when tapping is resumed after the annual rest. Except that no case has so far occurred in S/2, d/3, 67% the incidence is evenly distributed amongst the treatments.

Girth Increment.—The girth of each tree was measured in April, 1941, shortly after the commencement of tapping, at heights of 48 and 6 inches above the union, *i.e.*, above and below the tapping cut or cuts respectively. A second series of measurements was made at the same levels in January, 1942, and the increments for this period of 9 months are given in Table VIII.

TABLE VIII

Experiment No. 5. Mean Girth Increments (Inches)
April, 1941—January, 1942

Tapping System	G. 1		AV. 256		P. B. 25		Mean (All clones)	
	48 in.	6 in.	48 in.	6 in.	48 in.	6 in.	48 in.	6 in.
1. S/2, d/2, 100%	2·3	2·3	1·9	1·8	2·8	2·8	2·33	2·30
2. S/3, d/2, 67%	2·6	2·7	2·2	2·2	3·0	3·2	2·60	2·70
3. S/2, d/3, 67%	2·4	2·6	2·2	2·2	3·0	3·2	2·53	2·67
4. 2S/2, d/4, 100%	1·8	1·9	1·6	1·6	2·6	2·4	2·00	1·97

The reaction of all clones to the several tapping systems is approximately the same. In comparison with system 1, the reduction of the intensity to 67 per cent has increased the rate of growth while system 4 (2S/2, d/4, 100%) has depressed it. It is somewhat surprising that the latter effect is not more marked at the 6-inch level (below the cuts) than at 48 inches (above the cuts).

The retardation of growth due to system 4 was further examined in relation to the size of the trees. All trees were grouped into girth classes and the mean increments (combining measurements at both heights) on systems 1 and 4 calculated for each class. The figures are given in Table IX and indicate that the retardation is less marked for the larger than for the smaller trees. The practical significance of this conclusion is that the effect on the growth of the tree constitutes a greater objection to the adoption of 2S/2, d/4, 100% in the first year or two of tapping a young clearing than in later years.

TABLE IX

Experiment No. 5. Relation between Girth Increments on S/2, d/2, 100% & 2S/2, d/4, 100% & Size of Tree

Girth Class (ins. at 48 in.)	No. of trees	Mean Girth Increment		
		1 S/2, d/2, 100%	4 2S/2, d/4, 100%	4 as per cent. of 1
18-20	46	2·28	1·79	78·5
20-22	48	2·29	1·96	85·6
22-24	64	2·41	1·97	81·7
24-26	25	2·40	2·26	94·2
26-28	9	2·19	2·45	111·8

Experiments 6 and 7. Clones Millakande 3/2 and Hillcroft 28

These two small-scale experiments are considered together as they are of similar design and are both conducted at the Experiment Station, Nivitigalakele.

Experimental Details

Site and Previous Tapping History.—The experiments are in progress in clone trial plots at Nivitigalakele. The trees were mostly budded in the field in 1930, but there are a few budded or supplied in 1931 and 1932.

The experiments were started in March, 1940. The trees had previously been tapped for periods varying from one to four years on S/2, d/2, 100%.

Treatments.—The tapping treatments in Experiment No. 6 (MK 3/2) are given below. Experiment No. 7 (HC. 28) includes only systems 1 and 2.

Tapping System	Opening height of cut/s inches above union	Bark consumption inches per annum
1. S/2, d/2, (2×12m/24), 100%	36/23	6
2. S/3, d/2, (2×12m/24), 67%	36/23	6
3. 2S/2, d/4, 100%	36 & 23	2×3½

On systems 1 and 2 the trees were tapped in the first year (1940-41) on a panel starting at a height of 36 inches, and were changed in the second year to the opposite panel at a height of 23 inches Tapping was stopped for about a month in February, 1941.

Layout.—54 trees were available in the MK. 3/2 block. These were individually test-tapped on S/2, d/2, 100% for a preliminary period March-May, 1940. They were then placed in order of their yield and divided into 18 groups of 3 trees each, and one tapping treatment allotted at random to each tree in each group. There are thus 18 replications of single-tree plots.

The same procedure was adopted for Clone HC. 28, but only 20 trees were available. Thus there are 10 trees tapped by each method.

Owing to the preliminary uniformity trial the experimental tapping did not start until June, 1940, so the first tapping year consists of 8 months only.

Collection and Recording.—The methods are the same as those described for Experiment No. 5.

The results for the two tapping years are given in Table X.

Yield.—Both clones have reacted similarly to system 2 (S/3, d/2, 67%), the loss of crop being about 25 per cent

System 4 (2S/2, d/4, 100%) does not seem to be well suited to Clone MK. 3/2. The loss in crop is largely due to the increased incidence of Brown Bast. (See below).

Brown Bast.—Both these clones were shown to have a tendency to develop Brown Bast on S/2, d/2, 100% in previous tapping at Nivitigalakele (and elsewhere in the case of HC. 28), and one of the main objects of the experiments was to determine whether the incidence of this disease could be reduced by shortening the cut without too great a loss of crop. It will be observed from the table that there has been no Brown Bast with either clone on the reduced intensity, though the very small number of trees involved admittedly limits the value of the data. During the experimental period 2 trees (out of 18) have developed Brown Bast on S/2, d/2, 100% in the MK. 3/2 block, and 1 (out of 10) in the HC. 28 block. None of these trees, however, has had to be taken out of tapping, the affected area being small and isolated with a V cut.

System 4 (2S/2, d/4, 100%) has apparently increased the incidence of the disease in MK. 3/2. Not only are 4 trees out of 18 affected, but it was necessary to stop tapping all these trees during 1941.

Girth Increment.—The effect of tapping on a full circumference on two opposite cuts in restricting the growth of the tree is again shown by the girth increment figures for the second year.

TABLE X

Experiments Nos. 6. & 7. Clones Millakande 3/2, & Hillcroft 28. Budded in Field 1930/32

Tapping Systems	Tapping Year*	Millakande 3/2				Hillcroft 28			
		Mean Yield per tree in lbs.	Per cent. of S/2, d/2, 100% (total yield)	Brown Bast (of 18 trees)	Girth increment inches	Mean Yield per tree in lbs.	Per cent. of S/2, d/2 100% (total yield)	Brown Bast (of 10 trees)	Girth increment inches
1 S/2, d/2, 100% ...	1	11·8	100·0	—	0·8	10·4	100·0	—	2·9
	2	12·6	100·0	2	1·9	11·7	100·0	1	2·1
2 S/3, d/2, 67% ...	1	9·0	76·3	—	1·3	7·8	75·0	—	2·7
	2	9·1	72·2	0	1·9	8·5	72.6	0	2·7
4 2S/2, d/4, 100% ...	1	11·3	95·8	—	0·9				
	2	10·8	85·7	4	1·0				

*The trees had been tapped prior to the experiment (see text).

N.B.—The yields are calculated from the full number of trees whether in tapping or out of commission on account of Brown Bast, and are based on 260 tapping days per year.

Discussion

Although these experiments only touch the fringe of the problem of how best to tap the more important clones which are now reaching tappable age on estates in Ceylon, certain general deductions of an interim nature are nevertheless justified. The departures from the standard system of tapping on a half spiral on alternate days (S/2, d/2, 100%) which are considered in this series of experiments may be grouped under two headings: (1) reduction of the intensity to 67 per cent, and (2) increasing the interval between tappings to four days and maintaining the intensity at 100 per cent by doubling the total length of the tapping cut. The merits of these two expedients are discussed below in relation to yield and effect on the tree.

Systems of 67 per cent Intensity.—Any reduction in tapping intensity from 100 per cent to 67 per cent must cause at least a short-term loss of crop. In times of acute economic depression this may be justified by a complementary saving in tapping costs, but in normal circumstances it must be demonstrated that the milder systems evoke a notably more favourable physiological response from the tree so that there is a reasonable expectation of future yields being as high or higher than with the more intense tapping. In other words there must be some indication that the 100 per cent treatment cannot be continued indefinitely without inducing a high proportion of Brown Bast or some other untoward reaction.

The evidence from these experiments, limited as it is to three years with some clones and one year with others and confined to the wetter districts, does not suggest that S/2, d/2, 100% is too severe a system for any of the clones under trial provided a rest is given to cover the period of refoliation after the annual "winter." With this rest, and with the loss of tapping days caused by rain, the average number of incisions in the year is less than 140 on alternate day tapping in the experiments under review. Thus, although the intensity of S/2, d/2 is described as 100 per cent it involves considerably milder treatment than the application of the same system in most other countries or in the drier localities of Ceylon.

The data show that in general the trees react favourably to a reduction in tapping intensity in respect of the following factors:—

Yield (as compared with theoretical proportion)
Dry rubber content of the latex
Incidence of Brown Bast
Girth increment.

The advantages however, are not great and are considered to be insufficient to offset the loss of crop where rubber is selling at a remunerative price. Of the clones included in the trials Tjirandji 1

and Glenshiel 1 react most favourably to the milder treatments, and further data may show that the optimum intensity for continuous tapping is less than 100 per cent.

Consistent evidence is adduced that tapping on a third spiral on alternate days (S/3, d/2, 67%) is superior as regards yield to the half spiral third daily system (S/3, d/2, 67%), at least in the early years, though the cost of tapping will usually be lower with the latter method. The shorter cut, however, is unlikely to find favour on Ceylon estates and it does not appear to be necessary to *commence* tapping by this method. If, in any area tapped on S/2, d/2, 100%, the proportion of trees with Brown Bast becomes unduly high, say more than 10 per cent, the length of all cuts may be reduced to a third spiral.

It must be emphasised that these conclusions apply only to the wet zone. In the drier districts such as Kurunegala, Matale and Uva all systems become more severe owing to the larger number of tapping days, and the more conservative methods may be preferable.

Double-Four (2S/2, d/4, 100% and Full Spiral (S/1, d/4, 100%) Tapping.—The experiments indicate that as far as yield is concerned both these systems are somewhat superior to S/2, d/2, 100%, after the first tapping year, though the increased crop is wholly or partly in the form of low-grade rubber resulting from late drip. It is curious that the conspicuous advantage for full spiral tapping found in experiments in Malaya has not been reproduced.

To offset the gain in yield these systems retard the growth of the tree as expressed in girth increment, and it appears that this disadvantage is most pronounced with very small trees. The maintenance of a satisfactory rate of girth increase is obviously important with young trees which are, or should be, growing rapidly, and on this account neither of these systems is favoured for the first one or two years of tapping. The initial rate of bark renewal appears to be rather greater above the cut than on S/2, d/2, 100%, but since the bark is not to be tapped for 8 or 10 years this advantage may not be important. It may also be found later to be offset by poorer renewal below the cut when new panels are opened.

There is reason to believe that the incidence of Brown Bast may be increased by the adoption of either of these systems, at least in the case of certain clones, *e.g.*, TJ. 1, MK. 3/2.

The main practical conclusion emerging from these data is that in the main wet low-country districts alternate day tapping on a half spiral cut (S/2, d/2, 100%) is a suitable system on which to start tapping young budded areas. In later years this may be modified by shortening the cut to one-third of the circumference if the incidence of Brown Bast is unduly high (or alternatively

by increasing the interval to three days if economic conditions are such that the cost of tapping is more important than the yield per acre), or by the adoption of the double four (2S/2, d/4, 100%) or full spiral (S/1, d/4, 100%) systems.

Acknowledgments

The assistance of all those who have co-operated in the experiments on estates is gratefully acknowledged. Experiments Nos. 1 to 3 were carried out on estates in the agency of Messrs. James Finlay & Co., Ltd. to whom special thanks are due.

The writer is also glad to acknowledge the assistance given by Mr. C A de Silva, Assistant Botanist, in calculating the results.

FIELD EXPERIMENTS ON DARTONFIELD ESTATE—XVII

COMPARISON OF TAPPING SYSTEMS (1941)

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This paper presents the results of a tapping experiment with mature seedling Rubber on Dartonfield for the tapping year, March, 1941 to February, 1942, and summarises the results over a five-year period from 1937. Detailed results for earlier years will be found in the following publications :—

1. *Second Quarterly Circular* for 1939, (Vol. 16, Part 2).
2. *Third Quarterly Circular* for 1940, (Vol. 17, Part 3).
3. *Third Quarterly Circular* for 1941, (Vol. 18, Part 3).

Experimental Details

THE layout is in six randomised blocks, divided into two sets of three blocks each in fields 3 and 6, planted in 1917 and 1913 respectively. The yield per acre prior to the commencement of the experiment was 570 to 620 lbs. per acre on the "Double Four" tapping system (S/2+S/2, d/4, 100%). The yielding capacity of the trees was, therefore, above average.

Under a biennial programme of manuring on the estate, three rounds of manuring with a general mixture have been completed in the six blocks of the experiment up to the end of 1941.

The eleven systems of tapping under comparison, with abbreviations in accordance with the International Standard Notation for tapping systems, are recapitulated below :—

Two-day series

1. Half spiral on alternate days, with change of panel every six months. Bark consumption 5½ inches per annum. S/2, d/2, (2×6m/12), 100%.
2. Ditto with cycle of periodic rest, tapping for twelve months and resting for six months. Bark consumption 3¾ in. per annum. S/2, d/2, (2×6m/12), 12m/18, 67%.
3. Half spiral on alternate days, but on alternating sides, *i.e.*, the tree is tapped on alternate days and each cut once in four days. Bark consumption 7 in. per annum, S/2, d/2, (2×2d/4), 100%.

Two-day series

4. Two quarter spirals in echelon on alternate days, the bottom of the left cut being 6 in. below the top of the right. Change of panel every six months. Bark consumption 5½ inches per annum. S/4//S4, d/2, (2×6m/12), 100%.
5. "Double-Four," *i.e.*, two opposite half spiral cuts once in four days. Bark consumption 7 in. per annum. S/2+S/2, d/4, 100%.
6. Ditto with cycle of periodic rest, tapping for twelve months and resting for six months. Bark consumption 4¾ in. per annum. S/2+S/2, d/4, 12m/18, 67%.

Three-day series

7. Half spiral once in three days, with change of panel every six months. Bark consumption 4½ in. per annum. S/2, d/3, (2×6m/12), 67%.
8. "Double-Three," *i.e.*, two opposite half-spiral cuts once in three days. Bark consumption 9 in. per annum. S/2+S/2, d/3, 133%.
9. Ditto with cycle of periodic rest, tapping for six months and resting for six months. Sometimes known as Sunderland system. Bark consumption 4½ in. per annum. S/2+S/2, d/3, 6m/12, 67%.
10. Ditto with cycle of periodic rest, tapping for twelve months and resting for six months. Bark consumption 6 in. per annum. S/2+S/2, d/3, 12m 18, 89%.
11. Ditto with cycle of periodic rest, tapping for eight months and resting for four months. Bark consumption 6 in. per annum. S/2+S/2, d/3, 8m/12, 89%.

According to the usual Ceylon custom the trees have been rested during the refoliation period in February-March and the tapping year actually consists of 11 months.

Results

The results are presented in 5 main tables with comments on the outstanding features of the results. Graphs of cumulative yields published in former articles have been omitted owing to printing difficulties.

Yields.—Table 1 presents the experimental yields and the corrected or "adjusted" yields for 1941-42 in kilograms of dry rubber per plot of 30 trees, and the proportion of scrap (tree scrap only) for the tapping year is expressed as a percentage of the total crop. The table also includes, in the same units, the yields of the uniformity trial carried out in 1936-37. The figures show the initial yield differences on which the adjustment of the experimental yields has been based. An approximate conversion factor for expressing the results in pounds per acre is (×7).

The yield of system No. 1, (S/2, d/2, 100%), in 1941-42 remains at the same level as that of the previous year and the yield of 69.4 kilograms is not greatly different from the yield of 66.6 kilograms in the uniformity trial 5 years ago on the same tapping system, when allowance is made for the latter being the yield for 10 months tapping only.

Compared with the control, system No. 4, [S/4//S/4, d/2, (2× 6m/12), 100%] which is the two quarter cuts in echelon shows an increase of 9.9 kilograms, which is statistically significant. Table II which refers to the full period 1937-41, shows a steady increase in yield for this system from year to year since 1937, and the difference in yield, compared with the control, even in 1940-41 was not far below the level of significance. There is a decided advantage when the left quarter cut reaches the base, especially on large trees, and this may account for the improved yields. Difficulties are sometimes encountered in marking the quarter cuts on existing panels and two cups and two spouts are required on the half circumference.

The yield of the "double-four" system, (S/2+S/2, d/4, 100%) has dropped considerably in 1941-42, when compared with the previous year, but it still shows an apparent increase of 6.9 per cent over the control. The drop in yield can be partially attributed to the fact that in March, 1941, new cuts had to be opened, at a height of 30 ins., on a number of trees tapped under this system.

The most interesting feature of the results in Table II is the percentage yield figure for the "double-three" system No. 8, (S/2+S/2, d/3, 133%) in 1941-1942, which shows an increase of 28.5 per cent over the control, but over the period of 5 years the increase in crop is approximately 19 per cent. As shown later in Table VI, the number of trees out of tapping due to Brown Bast is relatively low. Hitherto, the "double-three" system has been looked upon as a form of drastic tapping, but the results at Dartonfield over a period of 5 years would seem to justify its adoption, in Rubber of average growth and yielding capacity, over a period of years, when maximum crops are required. A change over from the "alternate-day half-spiral" system to the "double-three" entails little extra labour.

The yields of the periodic resting systems of 67 per cent in the fifth year of tapping, remain considerably above those expected from the intensity of tapping, and the differences between the systems are not significant. The periodic systems 10, and 11 of 89 per cent intensity show a cumulative difference of 9.4 per cent in crop from 1937-42, the shorter cycle of 8 months in 12 has apparently resulted in improved yield, and this advantage has been evident from the first year of experimental tapping as shown in Table II.

Dry Rubber Content.—The annual dry rubber content figures from 1937 to 1941 are given in Table III. The differences between the various tapping systems are again not significant in 1941-1942. The dry rubber content of the "double-three" system remains at the satisfactory level of 40.2 per cent. The figure is reassuring and indicates that the general latex producing capacity of the trees has not been unduly strained.

Bark Renewal.—The bark renewal measurements were made in April, 1942, at a point previously marked to represent 12 months' renewal at the end of the tapping year, 1941-42. A correction of —1.0 millimetre has been made for use of the Schlieper bark gauge. The differences between systems of tapping are not significant and the rate of bark renewal for the double cut systems including the "double-three" remains satisfactory under the conditions of the experiment.

Brown Bast.—Table V gives the number of trees affected by Brown Bast during each tapping year from 1938 to 1941. The figures include not only trees out of tapping but those which, while showing symptoms of the disease, remained in tapping This method of recording tends to exaggerate the extent to which Brown Bast affected tapping under different systems. The returns for 1941 in Table VI are divided to show separately the number of trees with Brown Bast out of tapping and those which remain in tapping. As a matter of interest trees out of tapping from other causes are summarised in the same table. Of a total of 9.5 per cent of the trees out of tapping in the "double three" plots 2.8 per cent cannot be attributed to the tapping system, and the remaining figure of 6.7 per cent out of tapping is not unduly high. It should be noted that the yields have been calculated on the original number of 180 trees allocated to each treatment, irrespective of the losses given in Table VI.

TABLE I

Mean Yield in Kilograms of Total Dry Rubber per Plot of 30 Trees*

Year 1941/42

	Tapping Systems	Preliminary yields 936-37 †	Experimental yields 1941-42	Adjusted yields 1941-42	Scrap as % of total 1941-42
Sub-Block A Two-Day Series	1. S/2, d/2, (2×6m/12), 100% ...	66·6	69·4	66·3	9·6
	2. S/2, d/2, (2×6m/12), 12m/18, 67% ...	60·9	53·6	57·2	9·8
	3. S/2, d/2, (2×2d/4), 100% ...	64·1	70·4	70·2	9·9
	4. S/4//S/4, d/2, (2×6m/12), 100% ...	63·9	76·1	76·2	7·2
	5. S/2+S/2, d/4, 100% ...	67·8	75·4	70·9	8·8
	6. S/2+S/2, d/4. 12m/18,67% ...	62·3	50·1	52·0	9·3
Sub-Block B Three-Day Series	7. S/2, d/3, (2×6m/12), 67% ...	63·3	52·5	53·2	9·7
	8. S/2+S/2, d/3, 133% ...	65·5	87·1	85·2	8·2
	9. S/2+S/2, d/3, 6m/12, 67% ...	59·0	49·6	55·4	9·5
	10. S/2+S/2, d/3, 12m/18,89% ...	66·4	60·2	57·4	9·4
	11. S/2+S/2, d/3. 8m/12, 89% ...	63·6	64·4	64·9	8·4
	Mean	63·9	64·4	64·4	
	Standard Error ...			3·3	
	Sign. diff. (odds 19 to 1) ...				
	do *within* sub-blocks ...			9·4	
	do *between* sub-blocks ...			10·7	

* Approximate conversion to lbs. per acre × 7.

† Ten months' tapping only.

TABLE II

Adjusted Yields as Percentage of System No. I

	Tapping Systems	1937/38	1938/39	1939/40	1940/41	1941/42	1937/42
Sub-Block A Two-Day Series	1. S/2, d/2, (2×6m/12), 100% ...	100·0	100·0	100·0	100·0	100·0	100·0
	2. S/2, d/2, (2×6m/12), 12m/18, 67% ...	70·8	74·0	86·6	85·7	86·3	79·9
	3. S/2, d/2, (2×2d/4), 100% ...	110·4	108·6	109·3	111·6	105·9	109·1
	4. S/4//S/4, d/2, (2×6m/12), 100% ...	85·0	94·5	102·8	113·2	114·9	101·0
	5. S/2+S/2, d/4, 100% ...	96·8	105·7	107·4	115·2	106·9	105·9
	6. S/2+S/2, d/4, 12m/18, 67% ...	73·2	74·2	86·5	86·0	78·4	79·1
Sub-Block B Three-Day Series	7. S/2, d/3, (2×6m/12), 67% ..	67·8	71·2	79·5	85·7	80·2	76·2
	8. S/2+S/2, d/3, 133% ...	112·3	111·6	123·4	122·9	128·5	118·9
	9. S/2+S/2, d/3, 6m/12, 67% ...	69·0	73·6	82·1	85·1	83·6	78·0
	10. S/2+S/2, d/3, 12m/18, 89% ...	75·8	77·6	94·7	85·8	86·6	83·4
	11. S/2+S/2, d/3, 8m/12, 89% ...	81·0	89·0	101·0	99·5	97·9	92·8
	Mean ...	85·6	89·1	97 6	99·1	97·2	93·1
	Standard Error ...	3·4	3·8	5·1	5·4	5·0	3·8
	Sig. diff. (odds 19 to 1) ***within*** sub-blocks	9·5	10·6	14·4	15·1	14·2	11·0
	do do ***between*** sub-blocks	10·5	10·5	17·4	17·6	16·1	12·1

TABLE III

Dry Rubber Content Per Cent

Tapping Systems	1937/38	1938/39	1939/40	1940/41	1941/42
1. S/2, d/2, (2×6m/ 12), 100% ...	40·8	41·5	41·2	41·0	40·4
2. S/2, d/2, (2×6m/12), 12m/18, 67% ...	40·5	41·4	40·8	40·5	40·0
3. S/2, d/2, (2×2d/4), 100% ...	39·5	40·3	40·3	40·7	40·2
4. S/4//S/4, d/2 (2×6m/12), 100% ...	40·8	42·2	41·6	40·9	39·8
5. S/2+S/2, d/4. 100% ...	40·8	41·6	41·9	41·4	40·6
6. S/2+S/2, d/4, 12m/18, 67% ...	40·9	41·3	41·3	41·3	40·6
7. S/2, d/3, (2×6m/12), 67% ..	42·3	43·0	42·2	42·0	41·2
8. S/2+S/2, d/3, 133% ...	40·6	41·0	41·1	41·3	40·2
9. S/2+S/2, d/3, 6m/12, 67% ...	38·9	40·3	40·5	40·3	39·7
10. S/2+S/2, d/3, 12m/18, 89% ...	40·1	40·8	40·5	40·7	39·6
11. S/2+S/2, d/3, 8m/12, 89% ...	39·0	40·0	40·4	40·0	39·4
Mean	40·4	41·2	41 1	40·9	40·2
Error	0·51	0·46			
Significant diff. (odds 19 to 1) *within* blocks	1·4	1·3	Not significant	Not significant	Not significant
do do *between* blocks	1·4	1·4	do	do	do

TABLE IV

Thickness of Bark Renewal in Millimetres

Tapping Systems	1941/42 12 months
1. S/2, d/2, (2×6m/12), 100%	6·8
2. S/2, d/2, (2×6m/12), 12m/18, 67%	6 5
3. S/2, d/2, (2×2d/4), 100%	7·2
4. S/4//S/4, d/2, (2×6m/ 12), 100%	6·8
5. S/2+S/2, d/4, 100%	7·3
6. S/2+S/2, d/4, 12m/18, 67%	7·0
7. S/2, d/3, (2×6m/12), 67%	7·2
8. S/2+S/2, d/3, 133%	7·0
9. S/2+S/2, d/3, 6m/12, 67%	7·5
10. S/2+S/2, d/3, 12m/18, 89%	7·7
11. S/2+S/2, d/3, 8m/12, 89%	7·4
Mean	7·1

TABLE V

Number of Trees with Brown Bast

Tapping Systems	1938	1939	1940	1941
1. S/2, d/2, (2×6m/12), 100% ...	6	6	4	6
2. S/2, d/2, (2×6m/12), 12m/18,67%	0	2	3	3
3. S/2, d/2, (2×2d/4, 100% ...	3	5	8	8
4. S/4//S/4, d/2, (2×6m/12), 100%	2	4	7	7
5. S/2+S/2, d/4, 100% ...	3	5	11	12
6. S/2+S/2, d/4, 12m/18, 67% ...	0	4	1	3
7. S/2, d/3, (2×6m/12), 67% ...	3	3	4	3
8. S/2+S/2, d/3, 133% ...	8	11	12	14
9. S/2+S/2, d/3, 6m/12, 67% ...	4	6	3	3
10. S/2+S/2, d/3, 12m/18, 89% ...	4	5	5	5
11. S/2+S/2, d/3, 8m/12, 89% ...	3	5	7	7
Total	36	56	65	71

TABLE VI

Census of Diseased and Damaged Trees—1941

Tapping Systems	No. of Trees in Tapping		No. of Trees Out of Tapping									
	Brown Bast	As a % of Total	Brown Bast	As a % of Total	Dry Bark	As a % of Total	Thin Bark*	As a % of Total	Wind Damage	As a % of Total	Total No. of Trees out of Tapping	As a % of Total in Tapping
1. S/2, d/2, (2×6m/12), 100% ...	3	1·7	3	1·7	5	2·8	4	2·2	—	—	12	6·7
2. S/2, d/2, (2×6m/12), 12m/18, 67%	—	—	2	1·1	1	0·6	2	1·1	—	—	5	2·8
3. S/2, d/2, (2×2d/4), 100% ...	4	2·2	4	2·2	2	1·1	2½	1·4	2	1·1	10½	5·8
4. S/4//S 4, d/2, (2×6m/12), 100%	4	2·2	2	1·1	3	1·7	5½	3·0	2	1·1	12½	6·9
5. S/2+S/2, d/4, 100% ...	11	6·1	1	0·6	4	2·2	4	2·2	7	3·9	16	8·9
6. S/2+S/2, d/4, 12m/18, 67%	2	1·1	1	0·6	2	1·1	2	1·1	3	1·7	8	4·5
7. S/2, d/3, (2×6m/12), 67% ..	2	1·1	1	0·6	2	1·1	—	—	1	0·6	4	2·3
8. S/2+S/2, d/3, 133% ...	8	4·4	6	3·3	1	0·6	5	2·8	5	2·8	17	9·5
9. S/2+S/2, d/3, 6m/12,67% ...	2	1·1	1	0·6	1	0·6	—	—	1	0·6	3	1·8
10. S/2+S/2, d/3, 12m/18, 89 ...	5	2·8	—	—	1½	0·8	1	0·6	1	0·6	3½	2·0
11. S/2+S/2, d/3, 8m/12, 89% ...	6	3·3	—	—	2	1·1	3	1·7	3	1·7	8	4·5

*Bark under 6.0 mms. thickness

FIELD EXPERIMENTS ON DARTONFIELD ESTATE—XVIII.

MANURING EXPERIMENT WITH MATURE RUBBER (1941.)

L. A. WHELAN, *Soil Chemist* and C. A. de SILVA, *Assistant Botanist.*

This paper summarises the yield records and growth measurements for the fifth year of a manurial experiment on Dartonfield Estate.

The scope and design of the experiment and the statistical methods employed were described in the *Quarterly Circulars* Vol. 13 (1936) Parts 2 and 3 and Vol. 15 (1938), Part 1.

A biennial system of manuring is now used in this experiment. Manures were applied in March, 1941. The treatments are nitrogen alone (N), nitrogen plus phosphate (NP), nitrogen plus potash (NK) and nitrogen plus phosphate plus potash (NPK). A comparison has also been made of two methods of applying the manure, broadcasting and forking.

Results

Yield.—Table I gives the yield in kilograms of dry rubber per plot of 20 trees. To obtain the approximate values for pounds per acre each figure should be multiplied by 11. The figures in brackets give the adjusted yields as percentages of the unmanured plots.

TABLE I

Mean Yield in Kilograms of Dry Rubber per Plot of 20 Trees
(Tapped on 2S/2, d/4, 100% System)

Treatment	Actual Yield		Adjusted Yield				
	1936	1941	1937	1938	1939	1940	1941
N	53·4	44·3	49·8(111)	56·9(114)	44·5(112)	44·6(111)	43·9(115)
NP	52·3	38·8	47·5(106)	52·9(106)	41·5(104)	42·0(104)	39·3(103)
NK	55·5	45·4	49·1(110)	56·5(113)	44·1(111)	44·6(111)	43·5(114)
NPK	56·5	44·8	49·6(111)	59·3(119)	46·6(117)	47·4(118)	42·1(110)
O	47·1	33·9	44·8(100)	50·0(100)	39·7(100)	40·3(100)	38·3(100)
Mean	53·0	41·4	48·2	55·1	43·3	43·8	41·4
Std. Error			1·2	1·8	not significant	1·5	not significant
Sig. Diff. (odds of 19 to 1			3·5	5·3	not significant	4·3	

The 1941 figures just fail to pass the conventional test of odds of 19 to 1, but in the light of results from previous years a general response to manuring may be assumed. The NP treatment again shows a relatively poor yield indicating a depressing effect of large applications of phosphate when added to nitrogen. Previous results had shown the best response to an NPK mixture, but in 1941 the response to NPK is apparently below those to N and NK. This may be due to an intensification of the depressing effect of large quantities of phosphate brought about by increasing the application of Saphos phosphate from 1.35 lbs. per tree to 2.71 lbs. in accordance with the change from an annual to a biennial system of manuring. This is of course no argument against the application of moderate doses of Saphos (of the order of 70 lbs. per acre) such as is common in estate practice.

Method of Applying the Manure.—The figures for the comparison between broadcasting and envelope forking the manure are given in Table II.

TABLE II

Mean Yield in Kilograms Dry Rubber per Plot of 20 Trees

Treatment	Adjusted Yields				
	1937	1938	1939	1940	1941
Manure broadcast	48.5	55.1	43.4	44.0	41.0
Manure forked in	47.8	55.1	43.2	43.5	41.9

The results to date show no difference in yield between these two methods of application of inorganic fertiliser.

Girth Increment.—The mean figures for annual increments for the different treatments in the years 1937 to 1942 inclusive are given in Table III.

TABLE III

Annual Girth Increments (at 4 feet from the ground)

Treatment	Girth in ins. 1937	Increment					Total increment
		1937-38	1938-39	1939-40	1940-41	1941-42	1937-41
N	35·76	·56	·21	·19	·41	·25	1·62
NP	37·32	·63	·18	·17	·44	·33	1·75
NK	39·19	·62	·16	·10	·43	·27	1·58
NPK	37·10	·64	·23	·14	·37	·37	1·75
O	33·78	·55	·21	·15	·29	·38	1·58
Mean	36·63	·60	·20	·15	·39	·32	1·66

The differences in girth increment between differently manured plots are not statistically significant. The better growth for the period 1940-1941 noted in last year's report has been maintained during 1941-1942.

Bark Renewal.—Points were marked at the tapping level in February, 1940 and measurements of bark thickness were made at these points in January, 1941. The process was repeated for the period 1941-1942 using a new series of points. By this method only bark renewed after several applications of manure is measured.

TABLE IV

Thickness of Bark Renewal in Millimetres

Treatment	Bark Renewal 1940-1941	Bark Renewal 1941-1942
N	5.1	5.9
NP	5.5	6.0
NK	5.2	6.0
NPK	5.4	6.2
O	5.4	6.0
Mean	5.3	6.0

The general bark renewal may be considered as satisfactory. The small differences between treatments are not significant and it may be taken that manuring has caused no increase in bark renewal.

Cover Crop.—During the earlier years of the experiment the application of heavy doses of Saphos phosphate resulted in a luxuriant growth of the Pueraria cover. This has now become very thin all over the experimental area despite the continuation of the phosphate treatment, and an attempt is being made to establish *Desmodium ovalifolium*. It would appear that the application of manure is not the only factor in maintaining Pueraria under mature Rubber.

Summary

1. An experiment on Dartonfield Estate to determine the manurial requirements of mature Rubber is briefly described.

2. The results for the years 1937 to 1941 inclusive are given in terms of yield, girth increment and bark renewal.

3. Although the yield figures for the year 1940-41 do not reach statistical significance there are indications of a response to manures.

4. The yield from the NPK plots is apparently lower than that from N alone. This may be due to an intensification of the phosphate effect resulting from a change from annual to biennial manuring.

5. Manuring has had no effect on girth increment or bark renewal.

FIELD EXPERIMENTS ON DARTONFIELD ESTATE—XIX.

MEASUREMENTS OF GROWTH IN REPLANTED AREAS (1942)

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[This paper is the sixth in a series dealing with growth measurements in experimental areas of young Rubber on Dartonfield. Details of the scope and design of the experiments and annual progress reports will be found in the *Quarterly Circulars* for the period 1934-1941.]

No. 2 Replanting Experiment, 1938, 19½ Acres

THIS experiment serves for a comparison of the following manurial treatments N, P, K, NP, NK, PK, NPK, Compost and Control. Five complete blocks were replanted with budded stumps in May-June, 1938 and a sixth in the following November. In 1941 the manures were applied in September at the following basic rates per tree :—

Nitrogen (N)	16.5 oz.	sulphate of ammonia
Phosphate (P)	11.5 ,,	Saphos phosphate
Potash (K)	6.8 ,,	muriate of potash
Compost	29½ lbs.	sieved U.D.C. Compost

Girth measurements were made in June, 1942. A summary of the measurements to date and of the increments for the past 12 months is given in Table I.

TABLE I

Mean Girth in Inches per Plant

Treatment	June, 1940	June, 1941	June, 1942	Increment 1941-1942
O	4.45	7.06	10.06	3.00
N	4.14	6.84	10.02	3.18
P	4.41	7.46	11.55	4.09
K	4.47	7.00	10.17	3.17
NP	4.47	7.90	12.29	4.39
NK	4.55	7.56	11.03	3.47
PK	4.64	8.08	12.11	4.03
NPK	4.80	7.84	12.47	4.63
Compost	4.68	8.17	12.19	4.02
Standard Error		.310	.510	.255
Significant Difference	Not significant			
19 to 1 odds		.90	1.44	.72
99 to 1 odds			1.92	.96

The figures for 1942 indicate a highly significant response to NP, PK, NPK and Compost and a response significant at the lower level of probability to P alone. Differences between these manures are not significant.

The increment figures for 1941-1942 show highly significant responses to the treatments P, NP, PK, NPK and Compost, but again differences between these manures are not statistically significant.

When the figures in Table I are examined by the factorial technique, leaving out compost, the following results are obtained :—

TABLE II

Mean Girth per Plant in Inches

Treatment	Without N	With N	Without P	With P	Without K	With K
1942	10.97	11.45	10.32	12.10	10.98	11.44
Increase over unmanured	0.48		1.78		0.46	
Standard error			.324			
Significant Difference (odds of 99 to 1)			.891			
Increments 1941-1942	3.57	3.92	3.21	4.29	3.67	3.83
Increase over unmanured	0.35		1.08		0.16	
Standard error			.173			
Significant Difference (Odds of 99 to 1)			.473			

The above results show a highly significant response to phosphate, and smaller and statistically non-significant responses to nitrogen and potash.

A differential treatment of the green cover is also being carried out in this experiment. Loppings are envelope forked in one series of sub-plots and spread over the manured area in the other series. In 1942 the girth measurements for the two series were :—

Forking	...	11.31 ins.
Mulching	...	11.33 „

The results to date show no difference between the two methods of application.

No. 3 Replanting Experiment, 1936, 9½ Acres

In this experiment three methods of opening, three methods of planting and two types of manures are compared. Experimental manuring of this experiment ceased with the October 1941 appli-

cation In June. 1942 girth measurements were made of all plants in the area, and a summary is given in Table III. Previous measurements were made at a height of 3 feet above the union but as the stumped buddings were brought into tapping in March 1942 the girth measurements of these trees this year had to be made above the tapping panel, at a height of 4 ft. Measurements of budded stumps and field buddings taken this year at 4 feet showed an average value only 0.2 in. less than the average taken at 3 feet. All the measurements given in the table for 1942 were taken at 4 feet and the increments for the year were obtained from 3 feet measurements in 1941 and 4 feet measurements in 1942. The increments are not strictly correct, but are useful for a comparison of the different treatments.

TABLE III

Mean Girth in Inches per Plant

Budded stumps planted May, 1936. Stumped buddings planted May 1936. Seed-at-stake planted August-September, 1936, budded in field December, 1937 to April, 1938).

	1939	1940	1941	1942	Increment 1941-1942
Methods of Opening :—					
(1) Platforms	8.99	12.46	16.33	19.71	3.38
(2) Trenches	8.87	12.17	15.81	18.89	3.08
(3) Pitted Drains	8.07	11.39	15.11	18.35	3.24
Standard error	.198				
Significant Difference (odds of 19 to 1)	.69		not significant		
Methods of Planting :—					
(1) Budded Stumps	9.19	12.77	16.56	19.74	3.18
(2) Stumped Buddings	11.84	15.33	19.04	21.80	2.76
(3) Field Buddings	4.89	7.91	11.65	15.29	3.64
Standard error	.266	.273	.331	.357	.073
Significant Difference (odds of 99 to 1)	1.08	1.11	1.34	1.45	.296
Manuring :—					
(1) Organic	8.64	11.92	15.67	18.75	3.08
(2) Inorganic	8.65	12.10	15.83	19.14	3.31

Methods of Opening.—No significant growth differences are shown for the different methods of opening.

Methods of Planting.—The girth differences between the different methods of planting are still highly significant after 6 years, although the annual girth increment of the budded stumps is now

beginning to slow up whilst that of the stumped buddings has dropped to 2¾ ins.

Manuring.—The apparent difference of 0.39 in. in favour of the inorganic manure is not statistically significant. The increment figures for the year 1941-1942 show a significant difference of 0.23 in. in favour of the inorganic as compared with no difference the previous year. The response to manuring may also be investigated for each of the three systems of planting :—

	Stumped Buddings	Budded Stumps	Field Buddings
	inches	inches	inches
1942 Average girth	21.80	19.74	15.29
Increment 1941—1942 Organic	2.51	3.08	3.63
Increment 1941—1942 Inorganic	3.01	3.28	3.66
Difference in favour of Inorganic	0.50	0.20	0 03
Significant Difference (odds of 19 to 1)		0.22	

For the stumped buddings the inorganic manure shows a statistically significant difference of half an inch over the organic, but for the smaller budded stumps and field buddings the differences are smaller and not statistically significant. The results indicate that in this experiment the organics have so far not justified their extra cost, and that for the bigger trees the inorganic mixture may be preferable.

Summary

The 1942 girth measurements of two replanting experiments are summarised and the results discussed.

Four-year-old budded stumps have shown a girth response to phosphate of about 1¾ inches (statistically significant) and smaller responses of about half-an-inch to nitrogen and potash (statistically not significant).

No difference in girth of 4-year-old budded stumps has resulted from a comparison of two methods of applying green manure ; forking and surface application.

There is little difference in girth between trees planted according to the following systems : Platforms, Trenches, and Pitted Drains.

Plants budded in the field are still about 4½ inches in girth behind plants budded in the nursery and planted out as dormant stumps.

There is in general little difference between young trees manured with an organic mixture and those given an inorganic, but the bigger trees — those planted out as stumped buddings — appear to respond better to the inorganic.

MEETINGS

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the sixtieth meeting of the Rubber Research Board held at the Ceylon Chamber of Commerce, Colombo, at 2-30 p.m. on Monday, 23rd February, 1942.

Present.—Mr E. Rodrigo, C.C.S. (in the chair), Mr C. E. Jones C.C.S. (Deputy Financial Secretary), Mr. J. A. S. Agar, Mr. T Amarasuriya, M.M.C., Mr. W. P. H. Dias, J.P., Mr. L. M. M Dias, Hon'ble Mr. G. E. de Silva, M.S.C., Mr. J. D. Farquharson, J.P., U.P.M., Mr. L. P. Gapp, Mr. R. J. Hartley, Mr. R. C. Kannangara. M.S.C., and Mr. F. A. Obeyesekere.

Mr. T. E. H O'Brien, Director, was present by invitation.

Apologies for absence were received from Messrs. F. H. Griffith, M S.C. and N. D. S. Silva, O.B.E., J.P.

1. Minutes

(a) Draft minutes of the meeting held on 8th December, 1941, which had been circulated to members. were confirmed and signed by the Chairman.

(b) Matters arising from the minutes :—

Quarters for Junior Employees.—Construction of a further junior staff bungalow at Dartonfield was deferred pending consideration of the Board's war-time policy.

2. Decisions by Circulation of Papers

The decision to engage Mr. J. D. Hastings, 2nd Chemist of the Rubber Research Institute of Malaya, for temporary service was confirmed.

Agreed that rubber tubing or similar articles required by Government in the present emergency be supplied whenever possible.

3. Staff

(a) Dr. C. E Ford.—Reported that Dr. C. E. Ford had been released for military service overseas and had proceeded to India for training.

(b) Mr. R. K. S. Murray.—Reported that Mr. R K. S. Murray had resigned his appointment with effect from 15th February, 1942, to take up an appointment in the Department of Agriculture. A vote of appreciation of his services and good wishes for his future was recorded.

4. Accounts

(a) Statement of Receipts and Payments of the Board for the quarter ended 31st December, 1941 was approved.

(b) Fixed Deposits.—Reported renewal of three deposits aggregating Rs. 95,000 and transfer of one deposit of Rs. 30,000 to current account to meet anticipated commitments.

(c) Charges for Electric Current.—The charges for supply of electric current to staff bungalows were revised.

5. Miscellaneous

(a) Estate Items :—

1. *Widening of Approach Road.*—Agreed that the District Road Committee be requested to widen the approach road at intervals on the understanding that half-share of the cost would be borne by Dartonfield and Gallewatte estates.

2. *Purchase of Latex from Gallawatte Estate.*—Arrangements made for purchase of latex from Gallawatte Estate for the preparation of preserved latex were approved.

3. *Acquisition of Land adjoining Dartonfield Estate.*—The decision to buy a block of land in extent A.2-1-22 adjoining Dartonfield Estate was confirmed. after consideration of the lawyers' report on the vendor's title to the land.

4. *Food Production.*—Arrangements made for planting food crops at Dartonfield, Nivitigalakele and Hedigalla, in accordance with the Food Production (Estates) Order 1942 were approved.

5. *Power Supply.*—Reported that the new 20 h.p. Gardner engine had been installed. Agreed that the 9 h.p. Lister engine be transferred to Nivitigalakele and that the 5 h.p. Petter Engine be sold.

(b) Experimental Items :—

1. *Clone Museum.*—The Chairman reported that 4 acres of the area leased out on Kepitigalla Estate for this purpose had been cleared for planting this year.—Approved.

2. *Purchase of Clonal Seeds.*—Reported that in view of the impracticability of obtaining clonal seeds from the Dutch East Indies as previously agreed, arrangements had been made for the purchase of hand-pollinated clonal seeds locally.—Approved.

6. Curtailed Research Programmes for 1942

Research programmes for 1942 curtailed, in view of the reduced staff. to provide for the continuance of only the more important trials were approved.

7. War Time Policy

(a) Food Production.—Letters received from the Director of Agriculture and the Ceylon Estates Proprietary Association enquiring whether part of the Scheme's staff could be released for food production work were considered. It was agreed that the continuation of rubber research in Ceylon had assumed special significance in view of events in the Far East and it was considered inadvisable for the experiments outlined in the revised research programmes to be abandoned. As the continuation of these would fully occupy the staff at present available it was agreed that the only proposals that could be put forward were as follows :—

(a) To apply for the release of Dr. L. A. Whelan from military service for full time work on food production.

(b) To release the Smallholdings Propaganda Officer and his Instructors for similar work, either on behalf of Rubber producers or in connection with the general food production drive, (as appeared most suitable after discussion with the Food Production Officer).

(b) General Policy.—A Committee consisting of the Chairman, the Deputy Financial Secretary and the Director was appointed to make recommendations on various matters relating to war-time policy.

8. Publications

(a) Curtailment of Annual Report :—

The Chairman reported that owing to the departure of officers on military service early in the year it had not been possible for them to prepare their Annual Reports for 1941. He had therefore arranged for summaries of their work during the year to be prepared for embodiment in the Director's Annual Report which would be the only technical report for the year.—Approved.

(b) The *3rd Quarterly Circular* for 1941 and Advisory Circulars No. 15 and 16 were tabled.

The meeting terminated with a vote of thanks to the Chamber of Commerce for the use of its room.

Research Laboratories,
Dartonfield, Agalawatta.
10th March, 1942.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the sixty-first meeting of the Rubber Research Board held at the Ceylon Chamber of Commerce, Colombo, at 2 p.m. on Monday, 22nd June, 1942.

Present.—Mr. M. Crawford, Acting Director of Agriculture (in the chair), Mr. C. E. Jones, C.C.S., (Deputy Financial Secretary), Mr. J. A. S. Agar, Mr. W. P. H. Dias, J.P., Mr. L. M. M. Dias, the Hon'ble Mr G. E. de Silva, M.S.C., Mr. J. D. Farquharson, J.P., U.P.M., Mr. F. H. Griffith, M.S.C., Mr. W. N. Gunawardena, J.P., U.P.M., Mr. R. J. Hartley, Mr. R. C. Kannangara, M.S.C., Mr. J. L. D. Peiris and Mr. E. W. Whitelaw.

Mr. T. E. H. O'Brien, Director, was present by invitation.

Apologies for absence were received from Messrs. L. P. Gapp and N. D. S. Silva, O.B.E., J.P.

1. Minutes

(a) Draft minutes of the meeting held on 23rd April. 1942, which had been circulated to members, were confirmed and signed by the Chairman.

(b) Matters arising from the minutes :—

Temporary engagement of Botanist.—A letter from Mr. C. C. T. Sharp accepting engagement as temporary Botanist on the terms offered was read.

2. Board

(a) Changes in Membership.—The Chairman reported that as Acting Director of Agriculture he had assumed duties as Chairman of the Board with effect from 4th May, 1942.

The following changes in membership were also reported :—

1. Nomination of Messrs. W. N. Gunawardena, J.P., U.P.M., J. L. D. Peiris and S. O. Sirimane to represent the L.C.P.A. with effect from 18th May and 26th June, 1942 in place of Messrs. T. Amarasuriya, T. C. A. de Soysa and N. D. S. Silva respectively.

2. Renomination of Mr. W. P. H. Dias for three years from 10th June, 1942, as one of the representatives of the smallholders.

Messrs. Gunawardena, Peiris and Sirimane were welcomed to the Board and Messrs. Amarasuriya, De Soysa and Silva were thanked for their services.

(b) Petrol Coupons for Attendance at Board meetings.—Decided that arrangements be made to obtain a pool of coupons to cover members' attendance at meetings.

3. Smallholdings Committee

Recommendations made at meeting held on 22nd May, 1942 :—

Joint work with Co-operative Department.—Agreed that a loan of Rs 2,000 be made to the Hataraliyadde Co-operative Rubber Curing and Sales Society for construction of its buildings and equipment, subject to satisfactory arrangements being made regarding security.

4. Experimental Committee

Recommendations made at meeting held on 22nd May, 1942 :—

(a) Building Construction.—Modification of the building programme as recommended by the Committee, was approved

(b) Visiting Engineer's Report :—

Lathe.—Agreed that a lathe be bought if a suitable one was available at an economic price

(c) Water Supply.—Agreed that a new water pump be bought.

(d) Lease of Land at Hedigalla :—

Planting 20 acres with Food Crops.—Noted that an area of 20 acres had been cleared and divided into 22 plots in which a rotation of a variety of crops will be carried out.

Agreed that a further 10-15 acres be opened for N. E. planting for the production of foodstuffs.

Regarding the experimental planting of foodstuffs under mature Rubber it was noted that ½ acre had been planted with sweet potatoes and ½ acre with manioc. Half the area had been ridged for sweet potatoes and holed for manioc ; the other half had been envelope forked.

5. Staff

(a) Mr. M. W. Philpott.—Reported that Mr. M. W. Philpott, Chemist, had been released for temporary official duties out of Ceylon.

(b) Recovery of Salary Advances.—It was agreed that the salary advances to the Staff in April should be recovered in 18 instalments starting from June, 1942.

(c) Junior Staff :—

1. *War Allowance.*—It was agreed that war allowance on the revised scale adopted by Government should be paid to officers in receipt of salaries up to Rs. 200 per month.

2. *Medical Fund.*—Agreed that a Medical Fund for the junior staff be formed on the lines suggested by the Director.

3. *Dartonfield Conductor.*—Reported that Mr. M. D. T. Goonewardena had been appointed Conductor at Dartonfield with effect from 8th June, 1942

6. Accounts

(a) Balance Sheet and Auditors' Report for 1941 was adopted.

(b) Dartonfield and Nivitigalakele accounts — September 1941 to February, 1942 were tabled.

(c) Inventory Report for 1941 was adopted.

(d) Revote of 1941 Estimates.—Unexpended balances of certain 1941 capital votes, amounting to Rs. 13,609, were revoted and supplementary votes totalling Rs. 1,343 were passed

(e) Investments.—Sale of Rs. 20,000 Ceylon Government 3 per cent Loan Stock and Rs. 40,000 Ceylon Government 2½ per cent War Loan Stock was reported.

(f) Fixed Deposits :—

1. A fixed deposit of Rs. 15,000 at the Bank of Ceylon had been transferred to current account at maturity on 10th April.
2. A fixed deposit of Rs. 20,000 at the Imperial Bank of India had been transferred to London on fixed deposit for one year from 4th May, 1942.

7. Director's reports for the quarters ended 31st December, 1941 and 31st March, 1942 were approved.

The work done by Mr. Hastings, as recorded in his reports on the plasticity of rubber from individual trees and on the prussic acid content of manioc, was noted with interest.

8. New Rubber Planting

(a) Commercial Planting.—Agreed that the Chairman should write to the Minister for Agriculture and Lands expressing the view that new Rubber planting rights should be accorded to Ceylon.

(b) Seed Gardens.—Correspondence with the Director of Agriculture regarding the establishment of a seed garden of about 100 acres for the supply of material for commercial planting was considered. It was agreed that the Research Scheme should undertake responsibility for the establishment of seed gardens, but that no steps could be taken in the matter under present circumstances.

9. Reports to Government Departments, Etc.

Correspondence on the following subjects was reported : Tyre conservation and retreading ; rubber production in Africa ; self vulcanising rubber ; stocks of dusting sulphur

10. London Advisory Committee

Minutes of meetings of the Committee and the Technical Sub-Committee held on 26th September, 1941 were adopted.

11. Advisory Services to Estate Owners in India

Reported that the United Planters' Association of Southern India had decided to drop the proposals for advice by correspondence until the cessation of hostilities, as it was considered that the proposed subscription was too high for the amount of assistance which would be possible by correspondence under war-time conditions.

12. Disintegrator Motor

In view of a defect in the motor of the experimental disintegrator approval was given for the expenditure of Rs. 1,500 for a new motor and installation, if found necessary.

The meeting terminated with a vote of thanks to the Chamber of Commerce for the use of the room.

Research Laboratories,
Dartonfield, Agalawatta.
8th July. 1942.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the sixty-second meeting of the Rubber Research Board held at the Ceylon Chamber of Commerce, Colombo, at 2 p.m. on Monday, 24th August, 1942.

Present.—Mr. E. Rodrigo, C.C.S (in the chair), Mr. C. E. Jones, C.C.S (Deputy Financial Secretary), Mr. W. P. H. Dias, J.P., Mr. L. M. M Dias, Mr. J. D. Farquharson, J.P., U.P.M., Mr. W. N. Gunawardena J.P., U.P.M., Mr. L. P. Gapp, Mr. R. J. Hartley, Mr. F. A. Obeyesekere, Mr. J. L D. Peiris, Mr. S. O. Sirimane and Mr. G. R. Whitby, M.S.C.

Mr. T. E H. O'Brien, Director, was present by invitation.

Apologies for absence were received from Messrs. J. A. S. Agar, F. H. Griffith, M.S.C., R. C. Kannangara, M.S.C., and E. W. Whitelaw.

1. Minutes

(a) Draft minutes of the meeting held on 22nd June, 1942, which had been circulated to members, were confirmed and signed by the Chairman.

(b) Matters arising from the minutes :—

Petrol Coupons for Attendance at Board meetings.—The Chairman reported that the Petrol Controller had agreed to issue coupons to cover members' attendance at meetings.

2. Board

(a) Resumption of duties by Mr. E. Rodrigo :—

The Chairman reported that he had resumed duties as Chairman of the Board with effect from 7th July, 1942.

(b) Nomination of Mr. G. R. Whitby, M.S.C :—

The Chairman reported that Mr. G. R. Whitby, M.S.C., had been nominated as one of the representatives of the State Council with effect from 21st July, 1942, in place of Mr. E. C. Villiers who had resigned.

Mr. Whitby was welcomed to the Board and Mr. Villiers thanked for his services.

3. Director's Report for the 2nd Quarter, 1942

Chemical Department :—

Coagulants.—Agreed that further representations be made recommending priority for import of acetic and formic acid.

Botanical Department :—

Tapping experiment in 1934 replanted area.—In reply to an enquiry regarding the response of Tj. 1 to various tapping systems the Director said that in tapping trials carried out on estates clone Tj. 1 had stood up to 100 per cent tapping with a low incidence of Brown Bast ; the dry rubber content was low, varying from 2½ to 2¾ lbs. per gallon.

4. London Advisory Committee

The question of the contributions to be made to the Committee was considered. After discussing alternative suggestions for financing the work under present conditions the matter was left over for further review if the Committee was unable to obtain the necessary funds from sources in England.

5. Experimental Committee

(a) Estate Superintendent.—The Committee's recommendation for payment of an increased salary to the Superintendent, subject to engagement on a four year agreement from 1st July, 1942, was approved.

(b) Visiting Agent's Report :—

1. *Labourers' Quarters.*—The recommendation that a retaining wall be built round the front of the new cottage at Dartonfield was approved.
2. *Green Manure.*—The recommendation that supplying of creeping covers should be undertaken was approved.

3. *Manure and Transport.*—Agreed that the present manuring programme, as provided for in the Dartonfield estimates, be continued without change.

4. *Replanted Areas.*—The recommendation that paths be cut between the plants in the 12½ and 6 acre replanted areas at Dartonfield and in the 1939 clearing at Nivitigalakele was approved.

6. Staff

(a) Dr. L. A. Whelan.—Agreed that Dr. L. A. Whelan, Soil Chemist, be offered re-engagement for a further period of 4 years and 8 months from 30th April, 1943, on the terms laid down for officers recruited from abroad.

(b) Chemist's Laboratory Assistant.—Agreed that Mr. N. Palewandrem, Chemist's Laboratory Assistant, be promoted to Laboratory Assistants Grade I with effect from 1st June, 1942.

7. Accounts

(a) Receipts and Payments Account for the 1st quarter 1942 was approved.

(b) Dartonfield and Nivitigalakele accounts for March and April 1942 were tabled.

(c) Motor Mileage Rates.—Agreed that the increased motor mileage rates payable to Government officers be made applicable to Research Scheme Officers.

8. Publications

The policy to be followed in regard to the issue of publications under present conditions was discussed, and it was considered that producers would wish to follow up the results of experiments such as measurements of growth in replanted areas, tapping and manuring trials etc. Agreed that a Combined Quarterly Circular be issued shortly ; also that no subscription be levied for 1943 in in view of the reduced number of publications which would be issued in 1942.

The meeting terminated with a vote of thanks to the Chamber of Commerce for the use of its room.

Research Laboratories,
Dartonfield, Agalawatta.
3rd September, 1942.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the sixty-third meeting of the Rubber Research Board held at the Ceylon Chamber of Commerce, Colombo, at 2 p.m. on Monday, 2nd November, 1942.

Present.—Mr. M. Crawford (in the chair), Mr. C. E. Jones, C.C.S., (Deputy Financial Secretary), Mr. W. H. Attfield, Mr. W. P. H. Dias, J.P., Mr. L. M. M. Dias, Mr. J. D. Farquharson, J.P., U.P.M., Mr. L. P. Gapp, Mr. W. N. Gunawardena, J.P., U.P.M., Mr. F. H. Griffith, M.S.C., Mr. R. J. Hartley, Mr. R. C. Kannangara, M.S.C., Mr. F. A. Obeyesekere, and Mr. E. W. Whitelaw.

Mr. T. E. H. O'Brien, Director, was present by invitation.

Apologies for absence were received from Messrs. J. L. D. Peiris and S. O. Sirimane.

1. Minutes

(a) Draft minutes of the meeting held on 24th August, 1942, which had been circulated to members, were confirmed and signed by the Chairman.

(b) Matters arising from the minutes —

Coagulants.—Reported that further representations had been made recommending priority for import of acetic and formic acid.

2. Board

(a) Acting Chairman.—The Chairman reported that as Acting Director of Agriculture he had assumed duties as Acting Chairman of the Board with effect from 23rd September, 1942.

(b) Changes in Membership.—The following changes in the membership of the Board since the last meeting were reported :—

1. Mr. J. A. S. Agar had resigned and Mr. W. H. Attfield had been nominated in his place with effect from 28th September, 1942.
2. Mr. G. R. Whitby, M.S.C. had resigned on 13th October, 1942.
3. Mr. F. H. Griffith, M.S.C., had been renominated as a representative of the Planters' Association of Ceylon for a further period of 3 years from 15th November, 1942.

Mr. Attfield was welcomed to the Board and Messrs. Agar and Whitby thanked for their services.

3. Smallholdings Committee

Recommendations made at meeting held on 21st September, 1942 :—

(a) Estimates for 1943.—Detailed estimates of expenditure, as recommended by the Committee, were approved.

(b) Smallholdings Propaganda Officer's Report for the 2nd quarter 1942 :—

Food Production.—Agreed that the Smallholdings Propaganda Officer should serve on the Kalutara District Food Production Comittee if invited to do so.

4. Experimental Committee

Recommendations made at meeting held on 21st September, 1942 :—

(a) Commercial tapping at Nivitigalakele.—The recommendation that the 1926 and 1927 clearings at Nivitigalakele should be tapped on the double-three system was approved.

(b) Experimental planting —

1. *1943 planting.*—Proposals for 1943 planting, as recommended by the Committee, were approved.

2. *Planting distance trial, Nivitigalakele (1941).*—The decision that this experiment be abandoned and that an experiment of improved design be laid out at Hedigalla when circumstances permit was endorsed.

(c) Estimates for 1943.—Detailed estate estimates for 1943 providing for expenditure as follows were approved :—

Dartonfield	...	Rs. 31,839
Nivitigalakele	....	„ 22,039
Hedigalla	...	„ 14,253

(d) Intensive tapping experiment.—Proposals for an experiment to compare intensive tapping systems, as recommended by the Committee, were approved.

(e) Personnel of Committee.—Agreed that the present Committee members should continue to serve.

(f) Estate kaddy.—Agreed that the establishment of a kaddy at Dartonfield be considered by the Experimental Committee.

5. Staff

(a) Dr. L. A. Whelan.—Reported that Dr. L. A. Whelan, Soil Chemist, had accepted re-engagement for a further period of 4 years and 8 months from 1st July, 1943.

(b) Mr. M. W. Philpott —

1. Reported that Mr. Philpott had returned to Ceylon and resumed duties on 5th October.
2. Terms of re-engagement to be offered to Mr. Philpott, on termination of his present agreement on 14th July, 1943, were considered.

(c) Insurance against accidents.—Agreed that a policy be taken out to cover the Board against the risk of accidents to staff officers.

(d) Junior Staff Medical Fund.—Draft rules were considered and approved subject to certain minor amendments. It was agreed that the Fund should be started in January, 1945.

(e) Dr. C. E. Ford.—Reported that Dr. C. E. Ford had signed the supplementary agreement in respect of his period of military service. Terms of re-engagement on conclusion of his period of military service were considered.

(f) 2nd Laboratory Assistant, Chemical Department.—Agreed that this post, which had remained vacant since December 1941, should now be filled.

(g) Manufacture of vulcanised products.—Agreed that an annual statement showing the profit or loss on the manufacture of vulcanised products be prepared and that the prices of the products be reviewed.

6. Accounts

(a) Statement of Receipts and Payments of the Board for the 2nd quarter 1942 was approved.

(b) Dartonfield and Nivitigalakele accounts for May, June and July, 1942, were tabled.

(c) Estimates of income and expenditure for 1943 were approved as follows :—

Income		Rs. 383,185
Expenditure :—		
Revenue	Rs. 254,456	
Capital	„ 15,384	Rs. 269,840

Agreed that a Reserve for stabilisation of income be established by placing in reserve income from the cess received in excess of the amount due on 75 per cent of each year's standard production.

(d) *Investments.*—In view of present conditions the Board's policy in regard to investments was reviewed. It was agreed that :—

1. Rs. 50,000 be retained in current account.
2. Rs. 35,000 be placed in Ceylon Government 3½ per cent Home Defence Loan.
3. Rs. 20,000 be placed in fixed deposit.

(e) *Supplementary votes.*—Supplementary votes of revenue expenditure totalling Rs. 3,593 and capital expenditure totalling Rs. 2,684 were approved.

7. Reports to Government Departments

Reported that reports had been made regarding increasing the output of rubber from Ceylon, alternative sources of rubber and reclaiming of scrap rubber. Also reported that matters relating to rationing of fertilisers had been discussed with representatives of the C. E. P. A and the P. A. of Ceylon.

8. Manioc Drying House

A suggestion that a manioc drying house should be constructed at Dartonfield for demonstration purposes was not approved.

9. Seed Garden at Ratmalagara Estate

Reported that the Coconut Research Board had agreed to the establishment of a two-acre Rubber seed garden at Ratmalagara Estate.

10. London Advisory Committee

Minutes of meetings of the Committee and the Technical Sub-Committee held on 20th March, 1942 were adopted.

11. Next Meeting

It was agreed that the next meeting be held in mid January.

The meeting terminated with a vote of thanks to the Chamber of Commerce for the use of the room.

Research Laboratories,
Dartonfield, Agalawatta,
14th November, 1942.

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YOU IN INDUSTRY.—Make an intensive drive throughout your plants for waste rubber.

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[THE RUBBER RESEARCH SCHEME (CEYLON) KINDLY PLACED THIS SPACE AT THE DISPOSAL OF THE DEPARTMENT OF INFORMATION.]

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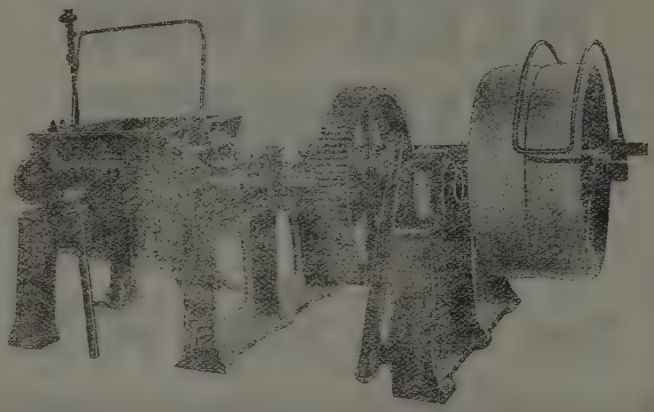

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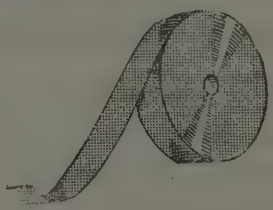

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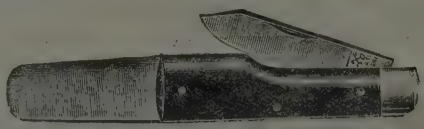

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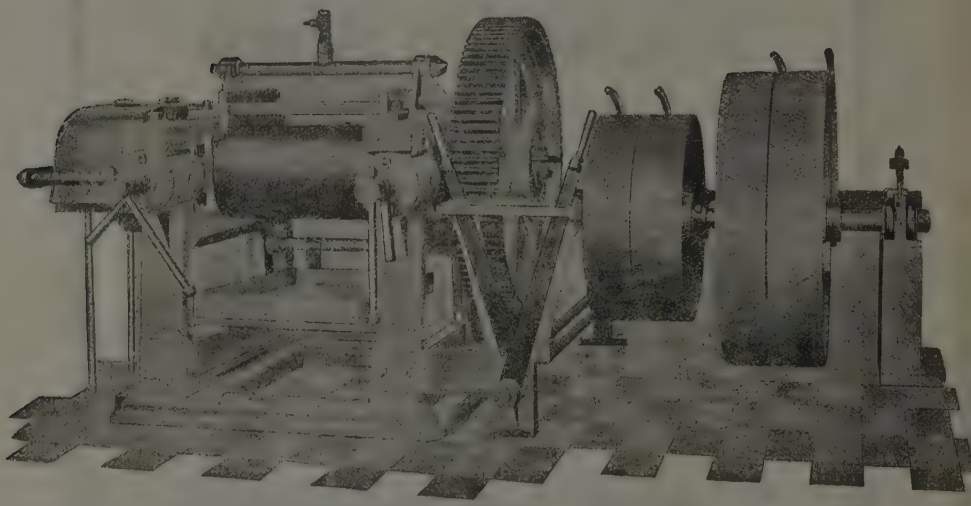

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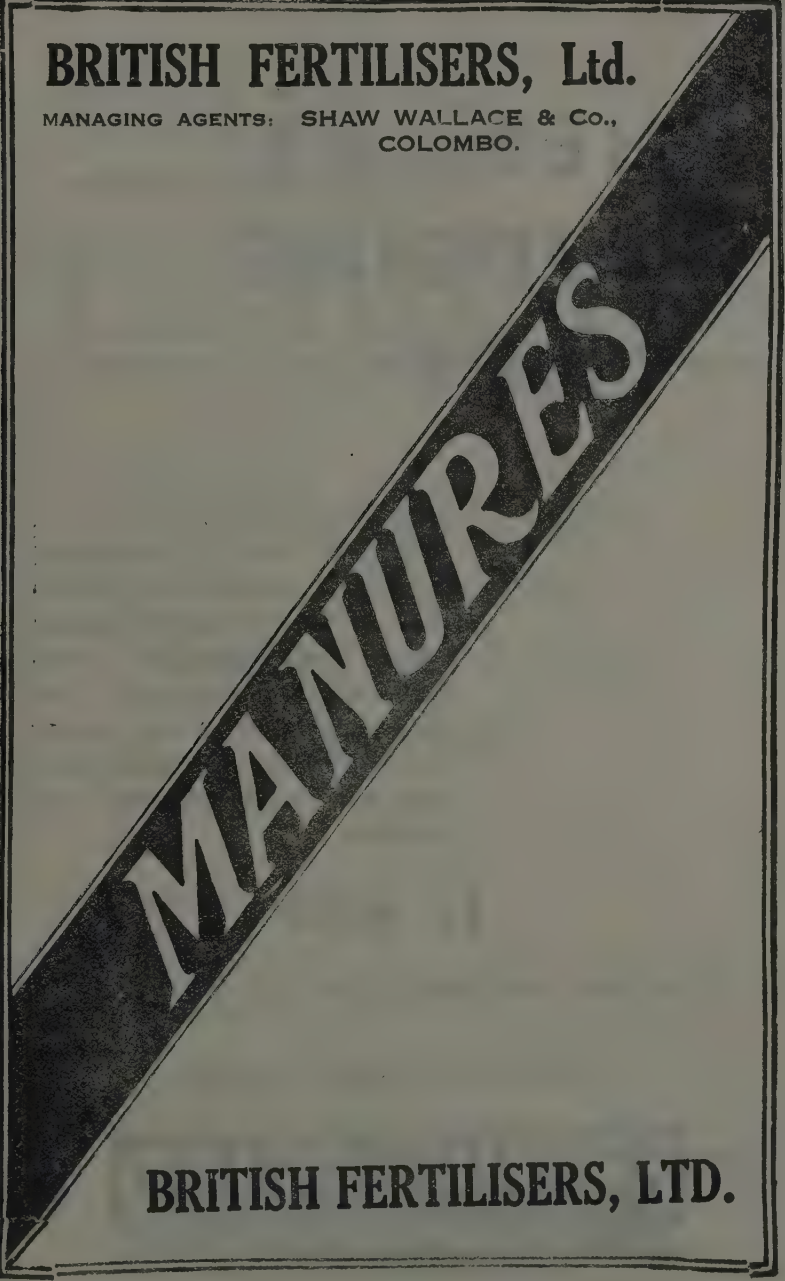

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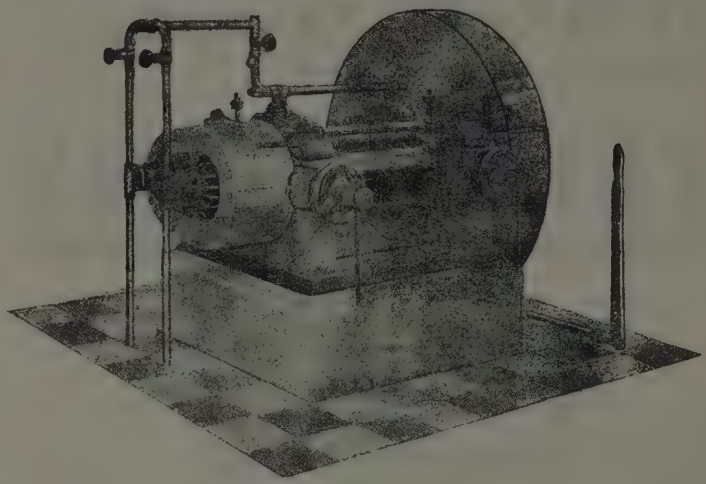

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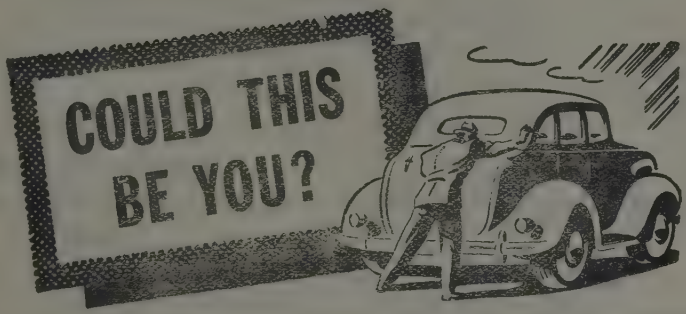

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Above	1,000 ,,	,, 2/-	,, 1/-	-/50

(Minimum quantity: 3 yards)

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First	100 stumps	-/60	-/30	-/25
Next	100 ,,	-/50	-/25	-/20
Next	300 ,,	-/40	-/20	-/15
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